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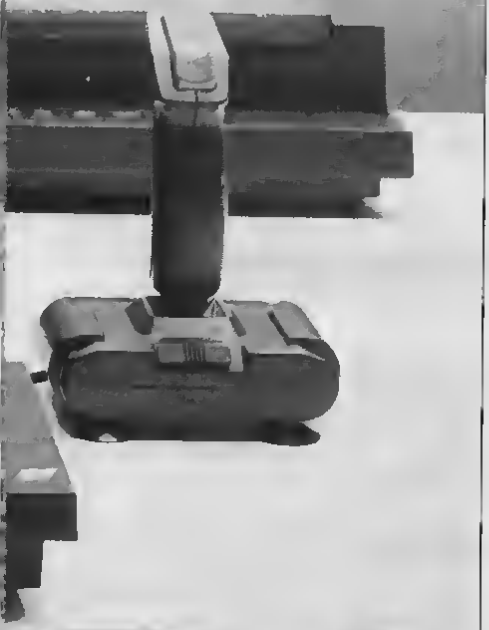

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*Price quoted refers to Discovery unit only

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CONTENTS

ASP FIGHTS SOFTWARE PIRACY

Much has been had and written in condemnation of software piracy but few have taken a positive stand against it ASP is among those few that have taken action to help curb the grave problem of home copying of commercial software

ASP has already taken steps to eliminate advertisements in our magazines which relate to tape duplication for piracy purposes While it is appreciated that individuals may take 'back-up' copies of their own programs it should be noted that it is *ILLEGAL* to copy commercially available software for other than personal use

Software piracy is costing the software industry huge sums of money which is detrimental to the future development of the industry It is in everybody s interests to dramatically reduce the level of software piracy primarily because firms need funds raised from software sales to plough back into research and development of new products This means that the standard of software products can only improve

ASP hopes our action will help combat this serious problem in order to maintain and improve the high standards of the UK software industry We are asking you to do the same by refraining from duplicating or copying commercially available software for anything other than personal use

MPUTING

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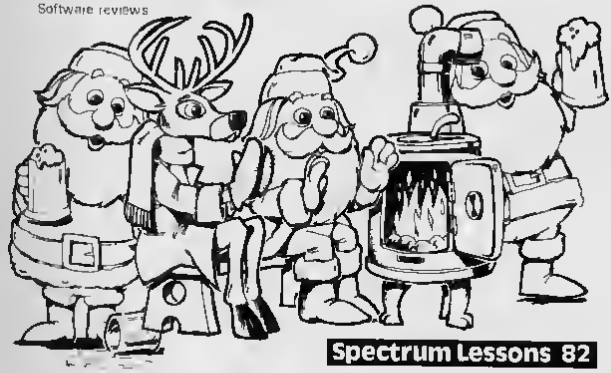

Welcome

At last as we all knew would happen Sinclair Research lowered the price of the QL in September Of course this s old news by now, but the effect w ll only just be starting to be seen and felt

The QL was always a superb machine at first in specifications only but latterly as the QDOS was improved and corrected in reality SuperBASIC is aptly named I prefer it to the Beeb s much vaunted BASIC and the possibilities of the 68000 processor have still to be completely exploited The biggest problem was (and still is in my experience) the microdrives Even with a computer new in August after making only six backups from Quill (for the purposes of reviewing d sk drives) the original has been ruined

Disk drives are the answer of course and several interfaces have been on the market for some time now However the combined cost has been prohibitive — in the realms of £650+ for the smallest system By knocking £200 off this total the QL becomes not only a viable proposition but taking the Psion software into consideration a very good deal indeed for the serious/small business user Just as importantly the basic machine now at £199 95 is within the price limits of many others hobbyists games players and those wishing to learn about computers Remember the Spectrum in its original rubber key form was only £25 cheaper when first launched and it sold like hot cakes!

Yes I know that the incredible development of technology has lowered cost and increased the ability of computers since then but even so the QL now represents one of the best value for money deals around So more people will buy the machine therefore the software market will (hopefully) expand and programs will become more available there is quite a reasonable amount available already (though the quality of some is rather dubious) the cost of software should come down and hopefully the QL should take off

And so to bed

This issue contains a special feature on graphics an area which most of us use in one way or another From the simplest games to the most complex business program all benefit from the judicious use of graphics We have attempted to cover a wide area in this feature and we are sure there is something here for you whatever your particular interest

And last but certainly not least may we all wish you a very happy ZXmas and one QL of a New Year!

Ray and Cliff

Cribbage

Dear ZX Computing
The Cribbage program in your Aug/Sept issue is great — the graphics are good (although the pegs don t quite get it right) and the game strategy employed by the Spectrum has quite often frustrated my own! However, the program as it stands is not quite the same as the one I grew up with

1 You must peg into the hole to score exactly 121 points
2 You cannot go out on a Jack! (I mean when you re on 119 and the other cuts you a Jack)

I cured this with the following lines

```
2925 IF s(player)+s 121
  THEN LET s=0
6002 same text as 2925
```

The following amendment is also required

```
8020 IF k=11 THEN
```

must be amended to

```
8020 IF k=11 AND s(player)
  119 THEN
```

I believe that I have sufficiently tested my version of this program (15 20 times) to be able to say that not only does it work but due to the Spectrum s penchant for flushes it can also find itself the occasional pegging hand when the crunch comes As the Spectrum has won a few more games than I have the program doesn t seem to lose any quality by introducing these rules The text of the instructions must also be amended to clarify these adjustments (line 9085 PRINT to reach quality 121 points (twice round the board) and an additional line 9550 PRINT AT 5 0 A card s now ' cut from the pack If a jack is cut from the pack then the dealer gets 2 points unless he already has ' 119 points (you can not go out on a jack) PAUSE 0 GO SUB clear)

I would also like to thank you and A J Carter for the article Adding the Plus from the same issue By pure chance I had ordered an upgrading kit a few days before buying your publication and despite now having to wait for the kit to arrive (understandable due to the summer holidays of the staff at the mail order firm) I have upgraded my Spectrum about ten times by now and can t wait for the kit to arrive so that I can get on with the real thing! The article is interesting helps to reduce the frustration of waiting and may well prove useful when the upgrading kit arrives
Yours sincerely
Philip Baker
West Germany

What does it do II?

Dear Sir
I have just read the article What does it do? by John Ure I have followed much the same course but without any of the many problems he seems to have had

I started by buying Interface 1 and Microdrive — no problem with fitting this unit if all went together in a few minutes and worked first time I then bought Tasword 2 and ten minutes work amending the program according to Tasman instructions saw it saved on a Microdrive cartridge At this point it was clear that I needed a decent keyboard so I opted for the expensive Transform unit Delivery was prompt ten days and fitting was easy about fifteen minutes The next step was a printer so once again I went to Transform and bought the Smith Corona TP1 I asked Transform to send it to my work address and they actually rang me up at work to check that I had the RS232 connector — I had not given my work phone number! The printer arrived two days later ten days after it was ordered The Sinclair RS232 connector came into use and after amending Tasword 2 to include the baud rate and saving the amended version I was in business The only problem I had was how to undeline, so I wrote to Tasman for help and within seven days I had the answer and all was well I have not had any problems with Interface 1 Microdrive Tasword 2 the Transform Keyboard or the Printer

My reply to the statement Don t you think a new typewriter would be better? is that I do not have to use Tippex anymore and amendment of mistakes is easy with Tasword 2 I can also store a balance sheet on Microdrive and by making a few simple amendments I can bring it up to date for each bi monthly meeting of the organisation of which I am the Treasurer Prior to this I have had to type out the complete

Balance Sheet for each meeting.

Finally, I can recommend Transform for quick service and a very sensible approach to customer relations. I also bought from them a Microdrive cartridge box and a dust cover for the keyboard: this was not immediately available but was sent to me about 14 days later, after they had checked that I still wanted it.

Yours faithfully
Major B K Whitworth
Salisbury

Decimal places

Dear Sir
I have just been reading this month's edition (Aug/Sept) of ZX Computing and was pleasantly surprised to see my letter regarding decimal places had been printed.

However, on checking the listing of the demonstration program I noticed an omission in line 80: this should read LET X=INT((10^P)*N)/10^P.

I also noted that my name had been spelt with an n instead of a p.

Regarding the problem of storing several screen images (Pen Pals, Aug/Sept issue) J Masters could probably make use of an excellent article on this subject by Duncan Overton in the Feb/March 1984 edition of ZX Computing.

Yours faithfully
J M Thorp
Swindon

Chatterbox

Dear Mr Elder
Please find enclosed a copy of my letter to Julian Chappell — you will see that I have asked him to include a note about my program in the next Chatterbox.

I thought I had better let you know as well in case you get any comeback from disappointed readers.

Having just received the latest copy of ZX Computing I was flattered that you had considered my program, ZXyphone, worthy of inclusion in your ZX Chatterbox column.

Unfortunately, in the transition from the SFSC Newsletter to the hallowed pages of ZXC an essential line of text went missing, namely — Set your machine in FAST — the program will not work in SLOW.

I am concerned that readers may not realise this and will be disappointed that their B1s remain mute. Please ensure that a 'correction' is included in your next column.

I have been getting a favourable reaction to the sound programs I have written — did you know that the sound can be channeled into a hi-fi through the MIC port? I am at present working on a sequencer which stores played notes for replay. We shall no longer be a silent minority!

Congratulations on your column — it should reach the parts other publications don't reach!

Keep up the good work!
Sincerely
Paddy Moindrot
Shropshire

Microdrive files

Dear Sir
I am writing to you because I think the following information may help with the problem of identifying what type of file has been saved to a ZX microdrive cartridge.

The problem arises when you CAT the microdrive: the CAT does not tell you what type of file(s) they are, whether:

a Program file
b DATA file
c SCREEN$ file
d a CODE file

While I was fiddling with SAVEing a file in different colours I noticed that I could SAVE programs and file with all sorts of colours. But of course the file name should not exceed 10 bytes. If while SAVEing a file you restrict the actual name to eight characters and the next two bytes to either one of the following: DATA, CODE or SCREEN$.

So when you are SAVEing a file you would do the following:

SAVE* "m" 1 "namexxxxx DATA" DATA ( ) (where DATA in the quote marks is extended mode D)

"m" 1 "namexxxxxSCREEN$ SCREEN$ (where SCREEN$ in the quote marks is extended mode / symbol shift K)

SAVE* "m" 1 "namexxxxx CODE" CODE Address, length where CODE in the quote marks is extended mode I

So when you do a CAT the following information is displayed:

CARTRIDGE NAME

namexxxxx if a program
namexxxxDATA if a Data file
namexxxxSCREEN$ if a Screen
namexxxxCODE if machine code

Of course when LOADing a file from cartridge you have to go through the same procedure except that you use LOAD instead of SAVE.

I hope readers find this information useful.
Yours sincerely
Omer Coruk
London

What does it do?

Dear ZXC
I want to say a few things about your 'What Does It Do?' article in the Aug/Sept issue. I am almost 12 and I have learned a lot. I was always baffled when I turned on the TV and saw people talking about sin, blah, cos, waffle. But I now understand these things. I like trying to program in m/c and BASIC. There's helpful software eg Collins Gem and you can make some very good software for yourself.

So thanks Sinclair for your popular inexpensive brilliant computers. If you're sick of Auntie Ethel's yak, then open up a briefcase and beat the hi score on Jetpac. Anyway, hard keys hurt my fingers and remind me of a certain computer beginning with a B. I like soft keys especially for playing games with.

Brian Gillespie
Crownhill
Plymouth

Mancomp

Dear ZXC
I took my Spectrum 48K and Interface 1/microdrive to my local computer repair shop, but they were unable to help me in any way.

Eventually I decided on Mancomp in Manchester and, after a

Kempston E

Dear Ray
I have some comments to make on your Apr/May edition.

Where was the latest edition of light screen designer? I would really like to see this finished!

Mr Tydeman also asked how to send multiple printer codes with the Kempston E interface. This is easy: enter either as a line of program or a direct command COPY REM CHR$ 0 (this stops the interface sending its own control codes, leaving the user in control. All that is now needed is for the user to enter as part of his program the lines of basic detailed in his printer manual for the facilities required.

For example, for my Epson RX 80 entering the line

LPRINT CHR$ (27);0; CHR$ (14)

will switch on the enlarged print mode.

In your article 'A Present from Uncle' you gave a method for altering the address at which the m/c code works from by altering the absolute jump address. Why not change the instructions to relative jumps. Then the routine will work from any address without further changes.

The Z80 JR instruction allows a program to jump up to either 127 bytes forward or 128 bytes backwards. This is quite adequate for the large print routine. To make the alteration LOAD the routine to its normal address of 32256 and then enter the following POKEs.

Why the routine was not written like this to begin with only Paton knows. The routine can now be saved and loaded back to any address. Just call the routine from the loaded address and hey presto it works!

The program 3 that you provided to alter the m/c code does not work! In line 10 you INPUT s and then CLEAR s 1. This makes my issue 2 Spectrum forget the variables! Giving an error code. Was this routine tested?

Thanks for the good mag and please give us more light screen designer!
Yours sincerely
Ed Cortwin
Wiltshire

POKE 32341,24	The JR instruction
POKE 32342,172	jump minus 84 bytes
POKE 32343,0	now spare!
POKE 32361,24	
POKE 32362,181	jump minus 75 bytes
POKE 32363,0	
POKE 32409,24	
POKE 32410,149	jump minus 107 bytes
POKE 32411,0	

short visit my Spectrum was working faultlessly

I would like to recommend Mancomp to all Spectrum owners

Yours faithfully
Andrew Duncan
Glossop Derbyshire
p.s. They make a good cup of tea as well

Cartoons

Dear Sir
I am a ZX Computing reader and enjoy your magazine very much. I particularly enjoy your amusing, topical cartoons. I enclose my own cartoon which I think you may like. I would be delighted if you would publish it.
Yours sincerely
Una O'Connor
Co. Kildare, Eire

And we're delighted to publish it. Una's cartoon is printed elsewhere in the letters page

Avast behind

Dear ZXC
Well shiver me timbers! Your typesetter must have been as anxious as you to get away on holiday. I fear you are in for some confused readers with regard to figure 1 (Program Layout) in my program Voyage of Peril (ZXC Aug/Sept).

The following corrections are required to reflect the original:

1 Add an arrow from box 100 to box 180
2 Box 230 should read Check course with wind
3 Add an arrow from box 230 to box 1200
4 Delete arrow head at bottom left of box 330
5 Add an arrow from box 310 to box 1400
6 Box 440 should read 4400
7 Add an arrow from box 3800 to box 4400
8 Add an arrow from box 3900 to box 4400
9 Add an arrow from the Trade Routine box to box 4400
10 Delete the horizontal arrow to box 1645
11 Add a horizontal arrow to box 1600 from the far left

The rest of the article is splendid so belay keel hauling the cat o' nine tails should be sufficient!

Thanks for a super mag.
Norman Brooks
Snodland, Kent

Oh well... actually to be fair it had nothing to do with our typesetters (who are a splendid bunch of people, especially since they can cause us all sorts of problems if we don't keep them happy). In actual fact it was all Jerry's fault — Jerry is the chap who does all our art work for us, and we don't have to keep him happy at all. So, memo to Jerry: IT'S ALL YOUR FAULT!!

Hex v Dec

Dear ZXC
After reading the letters in the Aug/Sept issue of ZXC I feel that I must reply to two of the letters that were sent in to you.

First, the reason why listings are sent in hex is that it's shorter. For example: AF B0 3C — three bytes in hex takes six characters whereas 175 176 60 — three bytes in decimal takes eight characters.

Not only is it shorter to write machine code in hex but hex always stays the same length so you can write long statements like A6 B4 C0. In decimal because the length varies (ie 201 or 15 — one has two digits, the other three), you must div de them with commas ie 166 180 192. So hex really is more convenient.

As for D.J. Shellhorn's letter about sound: six and eight channel sound can be made by linking the three channel sound and I/O interfaces from William Stuart Systems. Just one of these interfaces will provide three channel sound and sixteen I/O ports. Two units will provide six channel sound and thirty two I/O ports, while three units will provide nine channel sound and 48 I/O ports. However, no more than three units can be linked together.

I finish by congratulating you on your excellent magazine.
Yours sincerely
Simon Bryan
Nr. Newbury, Berks

'81 tips

Dear ZXC
In reply to G.M. Raines. I would be happy to swap ZX81 adventure tips if he would like to contact me.

Meanwhile, here are a few tips for the Arifcrange of adventures:

Planet of Death — wear the boots to retrieve the gold coin from the lake. Guards can be bribed. After firing at the force field, dance to the music playing on the radio.

Inca Curse — in the fire room get the lamp before putting out the flames. Ladders are very helpful to get onto high ledges.

Ship of Doom — silver rods + battery — sonic screwdriver. Improve your eyesight with glasses. Don't trust little girls. Fighting is better than running away. Look up frequently. Rope + hook = help.

Espionage Island — the first problem is solved by feeling the dark corner of the plane wreckage and then pulling. Unstrap parachute, do not go south, go west twice. Give the beads to the native woman who will drop a knife at your feet. The graffiti is important, so read it. Stitched is the same as sewn.

I would also like to hear from ZX owners who use their machine for programs other than games.
Yours sincerely
Mark Eldon
146 Fairfield Road
Heysham, Lancashire
p.s. I would like to know if any of your readers have any of the following issues of ZXC that they would like to sell: Volume 1 nos 1 2 9 10 11, Volume 2 nos 1 2.

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AMX MOUSE

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THE UNICORN

Offers more than just larger programs. It's all most sophisticated and when you consider that there's also a built in joystick port it really does look like Mikrogen have made a breakthrough. [Crash] The first ever Spectrum program to come with its own interface: to turn it into a 64K game! And there's a heart alignment routine too. Loads/saves to/from tape/microdrive. 104-page illustrated paperback with clues for the adventure. Map of the game. Even a Helpline phone number. And £500 to be won if you explore in this graphic adventure (Mikro-Gen) Cassette/interface £14.95

WORM IN PARADISE

A brand new adventure system from Level 9 is a major event! More rest than ever by compressing and many English over 50%. Vocabulary over 1000 words! Understands more commands than any other adventure. Plus 200 pictures and now with multi-tasking the game does not stop while the picture is drawn. No more waiting! Amazing. (Level 9) Cassette £9.95

Nato Alert

Shadow/Unicorn

Harker

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Marsport

New Games

NATO ALERT

A wargame simulating a non nuclear conflict in Europe between NATO and Warsaw Pact forces. 1 or 2 players. 5 skill levels. Up to 21 different objectives may be chosen to determine length of play. Complex but rivingly realistic. Map graphics help. Hints given too. No Stick. (CCS) Cassette £5.95

HACKER

Hacker is not like other computer games. We've told you how to beat the program. Everything else is up to you. A real life hacker would proceed by trial-and-error and that's how you play this game. That's what the Inlay card for Hacker says. So we won't tell you how to find out about Magma Ltd, or where your SRU's phlanmon valve is, or even what your vital SRU is. But there are good maps, lots of animated graphics and plenty of messages! The more you discover the more you enjoy it. (Activision) Cassette £8.00 While you're at it, why not buy yourself the HACKER'S HANDBOOK (150-page paperback) for just £4.95 as well!

MARSPORT

This is what the kids have been waiting for: an adventure game with restriction as well! The best yet (from Gargoyle) (Popular Computing Weekly). *Just watch John Marsh shoot. It is one of the best animation sequences ever seen on a Spectrum!* (Crash) Dun Darach in space! Not really, but Commander John Marsh has the same walk as Cuchulainn. Bell act animation with much improved 3D DEMO and SAVE available. (Gargoyle) Cassette £5.95

NOW GAMES

Excellent value: should keep you busy for months. If you're new to computing, you're laughing. (Popular Computing Weekly) This compilation tape contains: LORDS OF MIDNIGHT (Beyond); EIRIAN III ODDAXE (The Edge); PYJAMARAMA (Mikrogen); STRANGELOOP (Virgin); FALCON PATROL 2 (Virgin); ARABIAN NIGHTS (Interceptor). It is astonishing value for money. (Virgin) Cassette £8.95

SORDERON

Combines the best of text adventuring with the highly successful landscaping techniques to produce a game that sets new adventure standards. (Computer Games) *A true successor to the realms of Midnight... definitely shows the way forward.* (Sinclair User) 4,100 locations, 750 word vocabulary, 3 sentence command recall. Now you can see every step of your quest and talk to the characters you meet! Cheat Sheet available from Beyond if you get stuck. Score & Save. (Beyond) Cassette £4.95

"YOU'RE GETTING BETTER WITH EVERY CATALOGUE"
(K. Volkmann, W. Germany)

MONOPOLY

An excellent simulation, vastly superior to the other non authorised versions... the graphics are very realistic. (HCW) New Official Monopoly with 3D board view, for 2 to 6 players, any or all of whom may be the computer. Specify length of game if you wish. No Stick. (Leisure Genius) Cassette £9.95

BORED OF THE RINGS

An excellent and vast parody. Challenging and atmospherically written. (Popular Computing Weekly) Enhanced version of this huge, funny, beautifully graphical adventure spoof, loads in 4 parts. No Stick. (Silversoft) CASSETTE £6.95

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Shoptalk Shoptalk

Odds and ends, letters, and company info

A letter from Eclipse Software

Dear Ray and Cliff,
Thanks for the review of Letaset in the August issue, but your review in the same column for Scisoft's Astronomy disappoints! The program does not mention Halley's Comet and is in fact a rip off from my book *ZX Spectrum Astronomy* which Scisoft now admit and claim (in the trade press) to have withdrawn.
Yours sincerely
Maurice Gavin RIBA FRAS

Fighting words indeed, and perhaps Scisoft would like to reply. Also I would like to point out that in the News section in which we printed the items we are not reviewing products but simply passing on information supplied by the companies. If a review sample is sent then a comment may well be made and a full review either elsewhere or in a subsequent issue, may be written if we can find space to include it.

Finally I mentioned Halley's Comet as a reason why people may develop an interest in Astronomy and unintentionally introduced the implication that the program dealt with it. Sorry, sackcloth and ashes time again!

The Welwyn Currah speech synthesiser is an old favourite which is being repackaged for Xmas. If you fancy experimenting in this area it is a good buy and the fact that sound is routed through the TV will add to the effect

Race round Britain on Micronet 800

Not an actual county connection but a recently introduced game on the Micronet 800 service.

Developed by Mike and Lindsay Brown (Mike is the mind behind Chatline and Gallery) it is a simultaneous multi player game in which players travel around the UK searching for four secret locations. Clues are flashed onto the screen and as the race progresses your geographical position is indicated by a flashing cursor.

Regular £100 cash prizes are on offer to give you a chance to recoup some of your telephone bill. I haven't been on line for some time now but I will check this out as soon as I can find my modem.

BUD for RAM

RAM Electronics have taken over the BUD Computers range of peripherals. Their news release also informs us that they are about to release a new interface for the Spectrum incorporating joystick port, reset button, power indicator and expansion slot. This should be on the market in time for Christmas but no price has been quoted.

QL books from Longman

The latest in the Longman 'Working with the Sinclair QL' series is WORD PROCESSING WITH THE QL written by David Dempster. The book is aimed at three possible users of the Quill program supplied with the machine: absolute beginners, experienced computer users and experienced typists.

To enable the author to cover all these areas the book is written in a very simple manner and supported by many illustrations. If you have problems in getting to grips with the instructions in the manual then this book will supply the answers. I have been using WP's for some time now and I was able to learn a few things from the book. Chapters include: Introduction, Getting Started, Basic Editing, Filing on Microdrive, Formatting, Advanced Editing and Printing Techniques. There is also a comprehensive appendix section.

Mr Chips at home

Peter Ellis went through the usual gamut of confusion and frustration when learning to program and decided to produce a series of instructional programs to help others avoid the problems he had. HOME TUTOR is the result and consists of thirteen tapes dealing with such topics as basic instructions, program design, records, files, logic, peripherals etc.

If you are an absolute beginner and wish to learn in this manner then contact Fearless Software Ltd. We were not supplied with an address but ringing

01 402 3401 should find someone who will be able to help you

The course costs £9 80 per month plus £1 15 p&p alternatively it can be supplied quarterly for £30 00 a quarter

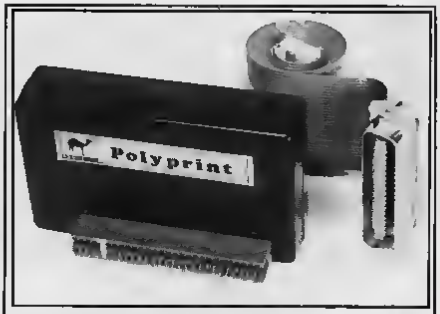
Replicating reality

An issue without a release from Interface Publications and Tim Hartnell is rare and this time presents us with Replicating Reality Exploring Computer Simulations This is a discussion of the simulating of real life situations and a set of programs which demonstrate various types of simulations This will be a useful book if your interest lies in this field especially if you are a relative newcomer to the computing scene

There appears to be nothing startingly innovative in the book and the concepts of most of the programs have nearly all been aired before however it is useful to have a collection of all the same type of programs and there is plenty of advice on how to construct your own providing of course you are familiar with programming in Basic

Chapters and programs include Power of Simulations Components of Simulation Feedback in Action Simultaneous Equations Life Robot Logo Stock Market and many more At £7 95 it is worth considering if you're interested in this field

Another Xmas goodie is the Joystick and interface combination pack offered by Vulcan Electronics for around £19 00! We've used the Gunshot joystick which is part of the package for reviewing games for about a year and it's stood up to all the punishment we could dish out



Getting into print

Camel Products have been around a while and have gained a reputation for producing specialist products The latest item from them is POLYPRINT a Centronics printer interface for the Spectrum The difference between this and other Centronics interfaces is that the operating system is on Eprom which saves loading a special program

Although the Kempston E and ZX Lprint III also have an in built operating system Polyprint's extra special feature is that it will allow text to be displayed on screen and printed in any of seven international charactersets French German Danish Swedish Spanish Italian and of course English These character sets match the Epson FX80's preprogrammed ones Polyprint provides List Lprint and Copy and is fully compatible with Tasword 2

They do mention that if the preprogrammed character sets are not enough then you also have the facility to modify and design your own Polyprint is £51 69 complete with cable and inc VAT and p&p from Cambridge Microelectronics Ltd One Milton Road Cambridge CB4 1UY

More joy with Mach 1

Will Cheetah ever live down their statement — the joystick is dead ? (Will we let them?)

Anyway from Cheetah comes the Mach 1 joystick which looks rather nice and it is claimed that it will withstand immense punishment I would have loved to put this to the test when reviewing Supertest and maybe we'll get time to try one out for the next issue

In this time of an almost confusing choice of joysticks the company claim that the three fire buttons make it worth choosing in preference to any other A built in auto fire switch is also featured Look out for it at your local store priced at a reasonable £6 95

The Saga continues

I was full of praise when I reviewed the Saga 1 Emperor keyboard from Saga Systems Ltd and now that they have launched their superb looking Saga 3 they are reducing the price of the original to £39 95

The look and feel of the Saga 1 made it one of my favourites to use here at the office and many an issue of ZXC was typed on it The other two keyboards in their range are the Saga 2 Profile at £49 95 and the top of the lot Saga 3 Elite at £79 95

Framed

The Gordon Microframe is one of the few peripherals designed to be expanded and developed in the style of the early pioneers of computing. In itself it is an open frame disk drive controller with connectors for a range of five special cards to be plugged in at will, these give a wide and versatile application to your computer.

OK, so it doesn't look as tidy and neat as most of the peripherals on the market, but if you are one of the many hobbyist computer users and want to get the most out of your machine then this system is worth looking at. The cards available to plug in at the moment include a Centronics interface, RS232 Modem drive, D A and A D converters, 64K paged map memory and there are more under development.

The main purpose of their contacting us this time was to let us know that they have now implemented Interface I and Microdrive syntax including Hook codes, to their Floppy Disc Interface. They tell us that all programs which will work with the microdrives will now work with their system.

The basic Microframe disk controller and chassis will cost you £149.50 and cards are priced between £10.00 and £64.00. If you are interested phone them on 0292 280467, or write to Gordon Micro Ltd, 3 Callendar Road, Heathfield Ind Centre, Ayr KA8 9DJ.

Seeing stars?

Eclipse Software have kept us informed of their products with gratifying regularity and they have added three new programs to their range.

HALLEY'S COMET is the only program we know of dedicated solely to the comet and appears to be the definitive computer work on the subject. £6.95.

ASTROLABE. Armed with a telescope and a Spectrum and this program you have a vast and accurate amount of information about the sky you see on any date. The perfect way to combine two hobbies. £6.95.

CHEMICAL FORMULAE is a databank and revision aid all in one. O and A level students should find it useful. £9.95.

Contact them at 79 Ardrossan Gdns, Worcester Pk, Surrey KT4 7AX.

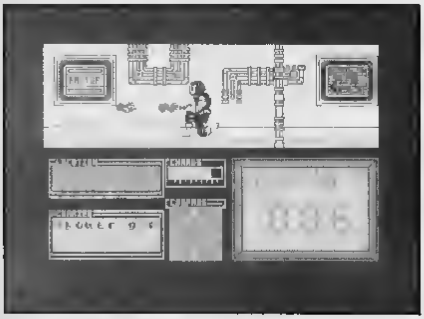
Under seige

Forget the Alamo, the whole Earth is under seige in Gargoyle Games latest three part series of programs. Covering 500 years from 2424, the first part, MARSPORT, has you taking part of John Marsh, searching the enemy occupied city of Marsport to find the plans which will strengthen the forcefield which is all that prevents the end of civilisation as we know it.

Described as a graphic adventure featuring the most sophisticated animation ever produced on a home computer, it has ten levels, 920 corridors and a host of puzzles and aliens.

Parts two and three, Fornax and Gath, are due out in January and April '86, and each part costs £9.95. We have all heard similar claims before but at that price they're going to have to deliver the goods.

If you can't afford Marsport then perhaps SWEEVO'S WORLD may fill the gap. Described as a funny arcade adventure it features Sweevo the clumsy robot. Sounds interesting at £7.95.



Melbourne mania

Melbourne House has earned a lot of respect from us punters but new programs from there are an infrequent occurence so the programs that they have released since our last issue are a welcome surprise

TERRORMOLINOS another off beat adventure from the authors of Hampstead and I am sure it will be a hit — probably by the time we go to press — it features the same sort of humour as Hampstead and although I only loaded it to give it a quick run through I was caught up in its atmosphere and ended up playing for over two hours

The post card style graphics are an interesting attempt at being different but I felt that the game, though improved, would have still been excellent without them £7 95

FIGHTING WARRIOR is similar graphically to Exploding Fist but your character uses a sword and has a complex quest to undertake We review it fully in The Jury

WHAM — THE JUKE BOX has something to do with the group of the same name and even though we saw an early version there is enough here to state quite simply that it is the BEST program for the musically inclined Spectrum user

Providing two simultaneous sound channels from the software alone plus rhythmic white noise options graphic representation of musical notation tempo editing looping and the ability to save tunes in a compiled form for use in your own programs either on its own or at the same time as a game is played Unfortunately we haven't the time for a detailed review as it really needs a week or so to do it justice I will give it a damn good going over and report in the music section next issue £14 95

Software news — In Brief

● For schools and colleges everywhere the information that a group of major educational software houses have joined together could well be a cause for celebration

BESA — British Educational Software Associates — has been formed to improve the distribution and supply of educational software Some of the companies involved are ASK Collins Widget and Griffin For more details write to BESA 4 Little Essex Street London WC2R 3LF

● Another group have joined together Ocean Software Projects Ultimate and US Gold have created a compilation tape of their oldest oops greatest computer programs Called HITSVILLE and priced at £9 95 this does actually represent good value for money especially if you are a relative newcomer to the computing scene The programs are Beach Head Decathlon Jet Set Willy and Atic Atac

● Adventure International's latest offering brings fiction's most durable hero to the computer screen ROBIN OF SHERWOOD — THE TOUCHSTONES OF RHIANNON is based on the recent TV series and follows the established format of an adventure with graphics

Sure to win as big a following as Gremlins and their other successes this program is available at £7 95

● I'm in two minds about Ouksilva's new game Schizofrenia Hectic and somewhat weird arcade action from a well established company for £7 99

● FSS produced Mcoder then Mcoder II and now after a lengthy pause MCODER III I loved Mcoder II even though you had to write in a kind of pidgeon Basic The latest version is claimed to compile the entire list of Spectrum Basic commands and handle full floating point arithmetic

For life in the fast lane look out for it at £12 95

● Last issue we mentioned the strange goings on at a certain St Bride's School and their Quilled adventure The Secret of St Brides We enjoyed it and said that subsequent programs were likely to be exciting as they developed their style THE SNOW QUEEN is the next and could be a biggie

Designed to be played whilst reading the copy of the novel included you do not control the main character but advise her This means she will not always do as you want and may even argue and answer back! It sounds unique and we'll try and get a copy and get our intrepid reviewer to give it a good talking to

Getting into Print

ZXC looks at two low cost, high quality printers.

Brother M 1009

Ibico LTR 1
Supplier Saga Systems, 2 Eve Road, Working Surrey GU21 4JT (04862 122977

If you use your computer for anything other than beating back never-ending hordes of aliens a printer is becoming almost an unavoidable necessity. As the QL includes the excellent word processing package Quill in the price, owning one without the accompanying printer is rather like owning a shotgun without any shells but its difficult even to take full advantage of the Spectrum without one.

The only problem is that printers of any quality can be horrendously expensive often costing twice the price of the computer. Fortunately prices have been dropping recently and — even better news — a range of low cost high quality printers looks certain. Basically the idea seems to be to give the buyer high grade print without all the added features that however desirable they may be add substantially to the cost. Already two machines of this type have appeared on the market the Brother M 1009 and the Ibico LTR 1 sold in this country by Saga Systems.

Brother M-1009

The brother machine is a lightweight (3kg) compact (330mm x 190mm x 70mm) near letter quality nine pin impact dot matrix printer designed to sell at just under £200. The connector cable costs between £15 and £20 depending upon where you buy it (alternatively you can make your own). There is an optional paper roller available (which costs around £20) as well as a dust cover and a pin feed unit. The operations panel consists of two pad keys (on-line and line feed) and three indicator lamps power error and on line. Printing is via a cassette type endless fabric ribbon with an estimated life span of a half million characters.

Printing is bi-directional logic seeking with a speed of 50 characters per second. The character set consists of 96 ASCII, 48 European 16 Greek 48 graphic and 21 mathematical and other symbols. The number of characters per line varies from 80 in the normal mode to 132 in condensed mode. There is an enlarged mode of 40cpi used mainly for headings and an enlarged condensed mode of 66cpi. Other features include superscript subscript, italics emphasized and double strike modes. These various print modes may be combined to give a striking varied output.

The print quality is excellent. As a writer I try to give editors polished manuscripts (but rarely succeed with a typewriter) and normally this would seem to call for a letter quality printer. But using the M 1009's combination of double strike and condensed modes is really all any reasonable person could ask for. I suppose one wouldn't use the M 1009 to write a party invitation to royalty but it should for just about everything else including the most picky of editors (*Are you trying to tell me something? — Ed*). It's not so much that the standard of print is radically different from other quality dot matrix printers but rather that you get the same sort of quality for a lot less money.

The emphasized mode itself is perfectly adequate for virtually any day to day use as is the condensed mode which looks marginally more like an obvious computer print out. The normal typeface is perfectly good but lacks the near letter quality of the emphasized and (especially the emphasized/double strike modes. The accompanying manual is fairly comprehensive but it could well do with an accomplished Japanese English translator to tidy up the grammar and idioms. My manual came with a set of addenda that was actually longer than the original thing.

The R version of the M 1009 looks to be pretty much the standard issue in this country and is the one most likely to interest Sinclair owners as it comes equipped with both a Centronics (parallel) and an RS232 (serial) interface. While it is perfectly possible to connect most parallel printers to a QL (and with a bit more difficulty a Spectrum) it requires yet another interface added to the labyrinth of wires at the back. This not only adds to the cost (some of the available interfaces are reasonably cheap but many are fairly pricey for anyone trying to build up a computer system on a limited budget) but it's another piece of gadgetry that can go wrong.

Some of the QL peripherals now being marketed (the Bright Star modem for example) carry a Centronics interface as an added extra but there is still a clear advantage in choosing a serial printer to link directly into the computer. After all if the peripheral acts up you can still use the printer to write a complaining letter to the company. If you need to alter the DIP switch settings they can be reached with any sort of small tool through a hole provided in the frame. Otherwise once you get the right cable everything is ready to go.

Ibico LTR-1

If you want high grade letter quality print at a very reasonable £120 (previously £169.95) then the LTR 1 is the (only) answer but it carries few if any additional features like the M 1009 the LTR 1 weighs 3kg but is slightly smaller measuring 298mm x 198mm x 63mm. It prints at 12cps and employs a unique golfball like head mechanism that takes its ink from a roller (replaceable at £2.50) situated directly behind it. The head is estimated to have a life span of 20 million characters and carries only one typeface Elite 12 to work with. The character set consists of 96 letters and symbols spread over a barrel like arrangement of five wheels.

The LTR 1 comes with a Centronics interface but there is a mechanism for adapting it to directly accommodate an RS232C connector to effectively convert it into a serial printer. It is designed for A4 paper (or anything smaller) and has an annoying paper feed rig knob that has to be pushed in to turn and is hard to get a real grip on. A slightly bigger knob offering a real grip would be a distinct improvement. Nonetheless anyone wanting straightforward computer printout and letters/manuscripts with a very high quality letter print at a bargain price should seriously look at the LTR 1. The print is indistinguishable from a good typewriter and would be ideal for anyone willing to sacrifice a bit of speed in exchange for an economical wordprocessor.

Both Brother and Ibico deserve a great deal of credit for bringing quality printing within a price range of the non dedicated computer hobbyist and the small business man toying with the idea of some computerisation. Of the two Brother's M 1009 is clearly the choice for those wishing to take full advantage of the capabilities opened up by linking a printer to a good computer but Ibico have provided the main essentials at a price that more people can afford. Both companies have taken advantage of the downward trend in printer prices by opting for quality output at bargain prices. In the long term it's the user that gets the benefits.

Brian Beckett

TASMERGE
THE MAIL MERGER

TASMERGE for the ZX 48K Spectrum cassette £11.90

Transfer data from MASTERFILE to TASWORD TWO! Letters and forms typed on TASWORD TWO can be printed with addresses and data taken from MASTERFILE. The mail merge facility allows for example multiple copies of a letter to be printed, each containing a different name and address taken from your MASTERFILE data. To use TASMERGE you must have one or more microdrives as well as TASWORD TWO and MASTERFILE by Campbell Systems (version 9 or later)

TAS-DIARY
THE ELECTRONIC DIARY

TAS-DIARY for the ZX 48K Spectrum and microdrives cassette £9.90

Keep an electronic day to day diary on microdrive! TAS DIARY includes a clock, calendar and a separate screen display for every day of the year. Invaluable for reminders, appointments and for keeping a record of your day. The data for each month is stored as a separate microdrive file so that your data for a year is only constrained by the microdrive capacity. TAS DIARY will work for this year, next year and every year up to 2100! Supplied on cassette for automatic transfer to microdrive.

ZX SPECTRUM

TASWORD TWO
THE WORD PROCESSOR

TASWORD TWO for the ZX 48K Spectrum cassette £18.90 microdrive cartridge £15.90

"Without doubt the best utility I have reviewed for the Spectrum" HOME COMPUTING WEEKLY APRIL 1984
If you have been looking for a word processor, then look no further" CRASH JUNE 1984
With 64 characters per line on the screen and a host of useful features TASWORD TWO is the ideal word processing package for the Spectrum owner

TASPRINT
THE STYLE WRITER

TASPRINT for the ZX 48K Spectrum cassette £9.90 microdrive cartridge £11.40

A must for dot matrix printer owners! Print your program output and listings in a choice of five impressive print styles. TASPRINT utilises the graphics capabilities of dot matrix printers to form, with a double pass of the printhead, output in a range of five fonts varying from the futuristic Dalek Run to the hand writing simulation of Palace Script. A TASPRINT gives your output originality and style! The TASPRINT fonts are shown below together with a list of compatible printers

TASWIDE
THE SCREEN STRETCHER

TASWIDE for the ZX 48K Spectrum cassette £4.90

With this machine code utility you can write your own Basic programs that will, with normal PRINT statements, print onto the screen in the compact lettering used by TASWORD TWO. With TASWIDE you can double the information shown on the screen!

TASCOPY
THE SCREEN COPIER

TASCOPY for the ZX Spectrum with interface 1 cassette £9.90 microdrive cartridge £11.40

The Spectrum TASCOPY is for use with the RS232 output on ZX Interface 1. It produces both monochrome (in a choice of two sizes) and large copies in which the different screen colours are printed as different shades. With TASCOPY you can keep a permanent and impressive record of your screen pictures and diagrams. A list of printers supported by TASCOPY is given to the left.

TASMAN PRINTER
INTERFACE

TASPRINT PRINTER INTERFACE for the ZX Spectrum £39.90
RS232 Cable for ZX Interface 1 £14.50

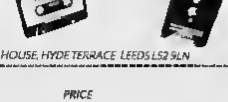
Plug into your Spectrum and drive any printer fitted with the Centronics standard parallel interface. Supplied complete with ribbon cable and driving software. The user changeable interface software makes it easy to send control codes to your printer using the method so successfully pioneered with TASWORD TWO. The cassette contains fast machine code high resolution full width SCREEN COPY SOFTWARE for Epson, Mannesmann Tally, Shinwa, Star, Tandy Colour Graphic (in colour) printers. TASCOPY shaded screen copy software for this interface (value £5.90) is INCLUDED in this package

The TASCOPIES and TASPRINTS drive all Epson compatible eight pin dot matrix printers e.g.

AMSTRAD DMP2000	NECPC-8023-N	BROTHER M1009
EPSON PX-80	MANNESMANN TALLY MT-80	BROTHER M1109
EPSON RX-80	STAR DMP 400/515/1000	SHINWA CP-80
EPSON MX-80 TYPE III	COMMODORE 801	DATAC PANTHER
		DATAC PANTHER II

COMPACTA - bold and heavy, good for emphasis
ORION-AND - A FUTURISTIC SCRIPT
LE TISH LIGHT - clear and pleasing to read
MEDIAN - a serious business like script
FAZIR - a distinctive flowing font

TASPRINT output shown at less than half size



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All prices include VAT, postage and packaging ZX

QL Delta Disk

Ray Elder goes to sunny Staines to investigate Technology Research's new interface.

Hello?

Hello... said a voice. It's been a long time.

Yes. I said, not having any idea what had been a long time and wondering which of my sins had found me out.

'John Rutherford speaking. TRL.' the voice said. I breathed easy knowing we weren't going to go through the 'Bet you don't know who this is' routine.

Why don't you come down and see our new QL disk interface?' John continued and so a year after I last travelled to Staines I found myself ambling west to visit Technology Research once again.

On arrival nothing had changed outwardly but inside the building the company had changed. rooms and I once more wandered the maze that is Unit 18. When I arrived the first thing that struck me was the neatness and comfort compared to their previous abode.

I was ushered into the main office where it was pleasant to renew the acquaintance of John, Steve Tam and Steve Mok. Also to meet C. Tang the production manager and Y. Cheuk the marketing director. Many happy moments passed discussing the state of computing in general the QL in particular and their interface in brief. I left with not only the Delta interface for the QL but also a new version of the Spectrum disk interface, the Beta Plus. There are a few surprises in that one for you... said Steve with a glint in his eye.

I took the Delta manual home to read because by the time I got to the office it was well past 6.00pm (overtime accountant please note) and anyway I prefer to read instruction manuals before trying things out. It can save a lot of frustration and even expense!

It took about twenty minutes to read the whole thing. I liked the simple informative manner in which it had been written — no previous knowledge is assumed — and not only are connecting and operating instructions given but also an outline of disk handling and disk drive types. Although it helps if you have a little computing knowledge I felt that someone who had bought a QL to use for business and had no knowledge of BASIC would be able to operate this system without too many problems.

After reading the manual even without access to a machine to try things out I felt I could operate the system.

Theory

The Delta Interface in basic form contains the Disk Operating System (DDS), a parallel printer port (Centronics) and a RAM Disk system. Extra on board memory of 64K or 128K can be supplied as an optional feature.

The DOS was written by one of the QDOS (the QL operating system) authors and is therefore fully compatible with both QDOS and the microdrive operations. Any choice of disk drive 5.25", 3.5", 3" single or double sided, 40 or 80 track and any combination of up to four drives can be used. The interface automatically determines which type is being used and performs accordingly.

Provided that the disk size is the same, many disk drive files are compatible, ie. a file written on a 40T SS drive can be read on an 80T DS drive. And an auto boot facility is also provided.

Most of the operating commands, except for a few special functions, are the same as the existing microdrive commands. All you have to do to use the disk drive is to use flp instead of mdv. In SAVE/LOAD commands. If you are using the printer port or the RAM disk then use par or ram instead of mdv.

These commands are mixable, so COPY*mdv1 file TO flp1 file will copy file from microdrive 1 to disk drive 1. The names of these devices can be swapped around so that built in SAVE/LOAD functions may operate without program modification, ie. FLP USE mdv will output everything to disk when a microdrive command is issued. Clever!

Practice

The interface is a neat unit designed in the same style as the QL, once plugged in it looks like part of the machine. On the left hand side of the case is the connector for the cable from the disk drive and at the back is the connector for the printer cable. The whole lot was assembled in less than ten minutes.

Although the printer interface is one of the lesser functions of the I/F it is very important as most printers on the market use this format. RS232 systems are available but usually cost extra to fit.

This worked a treat and a particularly useful function was the ability to specify the size of the print buffer. This can be to any size, memory permitting (and here the extra 128K was useful) and the result is that a lot of text can be held ready while the printer is operating but the QL is left free for other purposes.

The documentation was a little sparse on information here and a bit of trial and error was needed to get all the operations I wanted, but finally everything came together.

Bought separately, such an interface is priced at around £39.95.

RAM disk

Another extra, but again a very powerful one, is the ability to use a RAM disk. If a program is going to make many accesses to disk files during its operation then an area of memory (again the extra 128K was useful) can be used instead of the disk. This is created by giving it a number from 1 to 8 and specifying its size in sectors. All the disk information is transferred, altered, deleted or created in this area until the program is finished, at which point the whole lot can then be transferred back to disk.

This has two main advantages: first an incredible increase in speed, access is virtually instantaneous and secondly less disk use means less wear and less chance of corrupted files. A little more sophisticated knowledge is required to use this and it's an option that is probably only really usable by accomplished programmers. Of course, it's a valuable facility for commercial software houses to use in their programs.

Disk drive

The amazing versatility in the tolerance of drive types is handy if you already own a drive. The only thing that is not too clearly stated is that the drive MUST have its own power supply.

Using this was as easy as the manual led me to believe, the increase in speed and reliability was comforting. Although we have not tested it for a long period of time, I have been using TR's Spectrum interface for a year now and it has not failed once, therefore I have every reason to trust in the reliability of their QL interface.

In fact it was a joy to use and if this had been used instead of microdrives when the QL was first launched Sinclair Research would have had a hard time keeping up with the orders. Now that it is here it should make a great difference to the machine's potential.

I hope software houses will make use of the facilities provided when designing their programs and all users should consider this unit as being an important purchase. At the back of the manual is a wealth of technical information which hard software experts will find invaluable. I may even abandon the Spectrum and Tasword II now that I have a reliable medium for storing text on the QL.

The QL plus the Delta Disk drive means business!

Delta Disk Interface £129.50 with 64K RAM extension £199.00 with 128K extension £249.50. All prices are inclusive of VAT, but add £4.00 for p&p.

Technology Research Ltd, Unit 18, Central Trading Estate, Staines, Middlesex TW18 4XE. ■

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Once again, thank you for one of the best investments I have made Mr D L B (Feltham)

I would like to congratulate you on your excellent service – it is a rare thing these days – Mr L G P (Shrewsbury)

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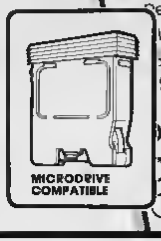

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CS

The Spectrum Beta Plus Disk Drive

A look at a new version of an old favourite.

Technology Research Ltd presented us with their new Beta Plus with an air of pride. Outwardly it looked the same as their old interface: a large box which lies flat behind the Spectrum but with the addition of two small buttons. However the capabilities are greatly improved. To briefly recap on the original specifications for readers who missed our review is probably a good idea.

The interface connects to the port at the rear of the Spectrum and has a through port on the back to connect further peripherals. It is fully compatible with the ZX Interfaces I and II and has a power supply socket — using the original Spectrum PSU — on the left and the disk connector on the right.

Up to four drives can be connected and these may be any type 40/80 track single or double sided and in any combination. They must however be double density drives and have their own PSUs.

A new feature of the interface is that the system checks the number and type of drives connected and operates them automatically when performing such operations as Format. Very clever. All the standard SAVE/LOAD operations are provided although VERIFY is not. After continual usage over a twelve month period with the first version I have never had a failed save.

The original version did not provide sequential loading and saving a 255 byte sector of code was included. The new version is greatly improved by the addition of both sequential and random access file compatibility the latter of which speeds up file operations. This was one of my few criticisms of the original.

The interface takes a mere 128 bytes of memory for its own use and is easy to use even if you only have a minimum of programming knowledge. The manual is a perfect example of how to write in a simple clear manner yet contains all the information any user could require. Converting such programs as Tasword II or Master file, two of the most likely programs to be used with a disk system, is very simple and takes only around ten minutes and four of those are loading the original from tape!

The interface has proved to be compatible with all the disks used with its predecessor.

Extras

Especially interesting to those such as myself who enjoy playing games as well as using it for business is the new Magic Button. This performs the same operation as the Miracle Microdriver does for Microdrives in that the whole of the Spectrum's RAM memory is dumped to disk by pressing the small button at the rear of the interface.

This means that ANY program can be copied to disk at least I tried it with some twenty games which included those with different fast loaders and protective code and all saved without problem.

There is a very slight problem in that this operation uses the first tracks on a disk, overwriting anything already there. This means that having used this operation you have to rename the file (all files so created are initially given a space as a filename) and then using the utility provided on disk transfer it to another disk. In this way I found you can store three programs on a 40 track single sided disk plus a main auto boot menu program.

Oh yes on power up or on pressing the little reset button on the side of the interface you now have the ability to automatically load and run a program called BOOT on the disk. If there is not such a program present then the system gives a disk error report and you can continue as you wish.

One thing that worried me at first was that because of the automatic sensing of the drives the drive is activated and the light remains on if no disk is in it on power up. Apart from giving me a moment of concern and a frantic call to TRL who assured me this was correct this has no effect and on inserting a disk the drive whirrs and settles down. No ill effects to the disks have been experienced.

The updated utilities disk provides more powerful programs to backup, catalogue and copy files and each is simple to use and a valuable bonus. Owners of the original TRL disk interface need not feel left out as they can update it for £23.95 inc VAT & P&P, a reasonable price and well worth having done.

The interface is on sale direct from TRL at £111.25 inc VAT and P&P.

Opinion

This is now THE disk drive interface for the Spectrum. I know of no other which provides such a comprehensive range of operations and facilities.

It's nearest competitor is the excellent Discovery all in one unit from Opus which although lacking some of the TRL features has a few different ones to offer such as printer, joystick and video ports. However TRL gave me the distinct impression that they have not finished with theirs yet.

Technology Research Ltd
Unit 18
Central Trading Estate
Staines

ARTWORX

THIS IS MORE THAN JUST MANIPULATION OF USER DEFINED GRAPHICS. You will find your own style developing as you become acquainted with the features of this stunning graphics package.

This first time we saw ARTWORX was on TV, staying at the office till two in the morning! The more you work with this program, the more you find you can do with it.

When first loaded a comprehensive menu appears. Pick your way down the sections such as FREE, LINE, CIRCLE, FOSITION, ERASE and MODIFY. Within these are degrees of variation accessed by moving the joystick controlled cursor to the option of your choice and hitting the fire button.

The screen changes to "canvas" and your cursor becomes a tiny paint brush activated and deactivated by pressing the fire button.

The speed at which the cursor moves and the thickness of the lines you draw are controlled by a 1-4 keyboard selection.

To change options, tap the space bar and you shot back to the menu to make a

You can create in multiples on screen and then move them around, reverse them, mirror them, expand or compress them, erase in part or in total, colour them using "solid", "shade", "background" and paper selections.

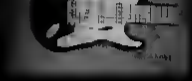
Then combine the individual in a complete package and later using any of four typeface variations to select the User Defined Graphics colour design your own typeface! Save it to tape, disk the printer or use Tasman's TasCopy to shrink or pro-rata to lay printer.

Also included is ARTWORX ALLEYS. You can store up to five designs and recall, reverse at random or cycle your master piece to create animation! This is one of those programs that once you see it run you've got to have, merit your own.

ARTWORX is fully compatible, functioning perfectly on Spectrum 48K and well work with Tasman's Printer Interface (a very popular menus that uses printer buffer software). Create some magic of your own ARTWORX.

£9.95 Includes VAT

Menu



Question: What new Spectrum game program provides a whole new selection of entertainment software, is neither arcade, nor adventure based, yet combines the best of both, is addictive with a tough test of your general knowledge?

Answer: TRIVIA 2000 — A television and best selling version of the popular board game!

Choose the number of players, determine how many questions each player is asked — Line up the contestants and see how well you can do.

The computer "taunts" to you, pleasing your backbone and hysteria when you are winning. The sound and beeps back each player's progress cannot be checked at any time, the number of questions asked, if, date, the percentage of the total answers correctly, all with so few distracting remarks or jokes. (This program tests your Spectrum, not an inquiry machine).

Trivia 2000 comes with a set of general Trivia questions. You can enter more questions separately — Sports, Celebrity, Science, Entertainment and General — Sets 1 and 2. Watch out for subsequent sheets for new category packs.

This is a great game individually, in multiple play and also a great way for non-popular users to experience the sensitive attributes of the Spectrum, it's also a lot of fun!

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Across the Pond

by Mark L. Fendrick

What is it about computers in general and Sinclair computers in particular that draws many of us so strongly to sit in front of a TV or monitor screen for hours at a time? The answer to that would have to be as varied as the people who own them and it is in that variety that the answer lies. Tonight, major league baseball went on strike and I find myself sitting at my desk looking to my T/S 2068 to fill the void. I find that I have to put my computer to many uses in the past few years something that not too long ago would have been nothing more than science fiction. But Clive Sinclair was the one to change that for me and since you are reading this column probably for you as well. Once the price tag for owning your own computer was in the thousands but Uncle Clive (not yet Sir Clive) changed that with the ZX80 and ZX81 and those of us who had dreamed of having one could now afford it.

But how many of us actually had a use in mind for our new computers when we first bought them? For that matter to what use do we put them now? Has it become a paper weight for lack of a worthwhile occupation, or a workhorse used daily? It is with this question in mind that we open this month's column.

First and foremost at the present time are the wordprocessing abilities of my T/S 2068. When I first started writing a column it was done on a conventional typewriter which meant that once I typed a sentence or two and decided to change it I either had to resort to tipp ex, or retype the entire page. With the wordprocessor however I am not committed to anything I type even after it is printed. Since my best thoughts seem to always come the second time around I cannot imagine being able to write this column any other way now.

Until recently, I made my changes, printed out a copy of the final result and then consigned the column to the U.S. mail and hoped for the best. The past few columns however were sent from New York to Europe in just a matter of seconds via electronic mail. (Read on ... the procedure for sending MSCRIPT files using MTERM follows later in this column.) From my T/S 2068 to an MCI print facility in Europe in less time than it took to read this sentence.

Comms

That brings us to another popular use for the Sinclair computers: telecommunication. With one of the two modems now on the market, you can turn your TS/ZX or T/S 2068 computer into a terminal to communicate with other computers via the telephone lines. In addition to the ability to send mail electronically, there are two other popular uses of a computer/modem combination. The first being the commercial services such as The Source, Compuserve and Delphi, which provide a wide range of services. From games to financial services, weather and news for a fee (based on the number of minutes you are connected) there is something for almost anybody. One of the most popular features of these services is user to user communications. Realtime conversations with other computer owners all over the country are one of the byproducts of this new technology. Many Sinclair owners have found out about the weekly conference each Wednesday night (at 10:00pm) on CompuServe. By typing GO PCS 54 dozens of Sinclair computerists can get together to discuss a wide range of topics.

For those of you who don't care to spend the money involved with these services there are the local bulletin boards maintained by individual computer enthusiasts. Many of them cater to special interests or particular computers. They consist mostly of a message base where callers can read and leave messages to each other and some form of data base with such things as newsletters or public domain programs. One such bulletin board which caters to the Sinclair community can be reached at (718) 296 2229.

To be honest though when I first ordered my ZX81, I really did not have any specific use in mind but soon thought of a few uses to justify the purchase. I was operating a photocopy business at the time and decided that what I needed was an invoicing program. Also the traditional home finance and checkbook uses seemed such a good idea and I anticipated putting my ZX81 (with Memotech 64K add on) to those uses. And not to ignore my wife's (less than) enthusiastic anticipation. I intended to transfer her gradebook to this new marvel.

In the months that followed I retreated to the bedroom (where the computer now held residence) and started the development of the necessary software. Soon my business records, home finances and checkbook had entered the computer age and the gradebook program grew to a full class management package. When I saw the lack of quality software of the market in those early days I sought publishers and my own Teacher's Gradebook (Timex) Invoice Control and the Financial Record Keeper series (Heath Computer Services) were marketed.

But how about you? What do you do with your Sinclair computer? Drop me a line and let me know what your computer is doing these days.

MSCRIPT

As promised here is the procedure for sending MSCRIPT files using MTERM and your Westridge modem. A few facts which are necessary for you to know before you begin are the address of the start of the MTERM buffer and how the MTERM software knows that there is something actually in the buffer. The answer to the first question is simple, as the MTERM buffer always starts at address 26710. You will need to know this address in order to place your MSCRIPT file in the proper memory.

Once you have SAVEd your MSCRIPT file to cassette in the normal manner, note the length of the file (from the MSCRIPT command menu) and then remove the tape from the recorder and place it aside. Now take a fresh blank tape and place that into the recorder. Turn your computer off and then back on to clear the MSCRIPT program from its memory. In command mode type in SAVE "file" CODE 26710, filelength where filelength = the length of the MSCRIPT file noted earlier. You may use an alternative substitute a number such as 20000 which will cover any file you would ever want to LOAD and keep this tape for future use. It is not necessary to have anything to SAVE in memory as all we are interested in here is the creation of a dummy header. The reason for this is that MSCRIPT SAVEs its files with a non standard header which can not be reLOADed using the normal Sinclair LOAD command. This will create a header with the information concerning the address to which the file is to be reLOADed as well as the file length. Press the ENTER key and any other key to start the SAVE procedure but as soon as the header (the short first part of the SAVE) is recorded you may stop the tape and press the CAPS SHIFT/BREAK combination to stop the procedure. Now rewind this tape and remove it from the recorder. Replace the tape containing the MSCRIPT file (do NOT enter the MSCRIPT software though) and type LOAD "". As soon as the header has been read (you will not get any file name) stop the tape and manually rewind the tape one quarter turn of the hub. Now remove the tape and put in the tape with the dummy header. Type LOAD "file" CODE and press ENTER. As soon as the header is recognised and read stop the recorder (DO NOT PRESS BREAK) put back the MSCRIPT file tape and press PLAY on your recorder. You will see the familiar reading pattern which will probably end with an error message. Don't worry nothing is wrong and it should be expected. Stop the tape and LOAD your MTERM program but do not PRINT USR 54016.

If at this point you were to go to the MTERM menu, the buffer would show that it is empty. This is because the end of the buffer is indicated by the system variable VARS. If you were to investigate you would find that VARS is currently pointing to address 26710. POKE 23628, 200 to change that and then activate MTERM. Now you will find that the program recognizes that your file is in the buffer. You can now transmit it in the normal manner.

Take my word for it it is not really as complicated as it sounds and once you do it once or twice you will see how easy it really is.

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Micro Peripherals QL Disk System

We take a look at the Sinclair approved unit for disk storage on the QL.

It was a surprise to many when Sinclair Research officially endorsed the Micro Peripherals disk system as it was the only one on the market at the time which did not contain software written by the QDOS author. However when the system arrived on our desk for review we could see some of their reasons.

First Sight

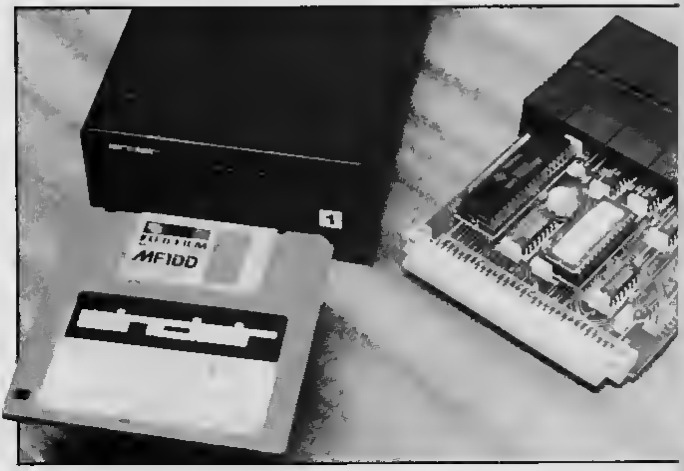
The interface looks much like any of the others on the market in that it fits into the port on the left of the QL flush to the case and in the same style as the QL itself becoming an integral part of the machine. The drives plug into a standard connector on the left.

It is possible to use the interface with drives other than their own providing the drive attached is 80 track, double density, single or double sided has its own power supply and a maximum track step time of 6ms. However, probably due to the specific nature of the drive requirements the marketing approach has been to offer one of two packages: an I/F plus one 3.5 720KB (formatted) double sided double density 3ms Track step time or an I/F plus two of these drives. The drives are small neat black units with a PSU attached by a 6 pin Din plug to the centre of Drive 1. A ribbon connector cable runs from the drive to the I/F.

The second drive is different from Drive 1 in that it has a power lead ending in a 5-pin Din plug which connects to Drive 1 and a short ribbon cable which also connects to the rear of Drive 1. Both of these are permanently attached to Drive 2. These drives can sit side by side or on top of each other. The whole system looks very smart and attractive and compliments the QL in appearance.

The software consists of a set of detailed instruction sheets which fit into the QL manual. These are written in the same style as the manual: simple step by step initial instructions followed by in-depth details. The typeface is different but I found it easier on the eyes. Also included is a disk of utilities. These consist of:

REPOS_BAS allowing modification of up to 9 windows



BACKUP_X a versatile file copying program
EXCHANGE_X a string search and replace of files
DEL_FILES_X to delete files
EX_DIR_X a detailed directory utility
INSPECT_X allowing examination and modification of specific files
SPOOL_X allowing transfer of files in ASCII form
COPY_X for single file transfers
REDIRECT_X moves files to various outputs such as a printer
COLPRINT allows printing from a mode 4 screen to a suitable colour printer
D A M E a Disk and Memory Editor

This latter program is a very powerful aid to manipulating files working as it does at sector level All these are excellent and provide a good range of valuable utilities for the experienced programmer

In Use

Connecting to the QL is simplicity itself and no problems were experienced There is an option to set the interface before fitting so that single or double sided drives are specified track step time and whether or not the disk is called on power up instead of the microdrives for autoboot

To use the disk systems FDK is typed rather than MDV a software option exists to switch operating modes so that the disk operates on MDV instructions DGET and DPUT give you the ability to read or write a 512 byte sector of the disk VSET is useful as you can assign a three letter name of your own choice to the drives I found this meant that existing software on disk using FLP could be used

Using the system is reasonably straightforward although it was a good week before I felt confident enough to operate the system without the manual beside me Having grasped the essentials the system produced no nasty surprises

Conversion of the four Psion programs was accomplished with reasonable ease although it took a few tries before I found that it worked best to copy the program load the CONFIG_BAS program flip the machine to use FDK in place of MDV then run the program and proceed as normal

It seems strange that the four programs were not supplied ready for use on the disk after all the originals were supplied with the machine and the unit is under the Sinclair banner If this had been done it would have made it much more attractive for the owner or prospective buyer who only wanted to use the machine and not have to cope with this operation

A variety of other software by Sinclair Micro Power and Talent Systems also converted without problem

Comments

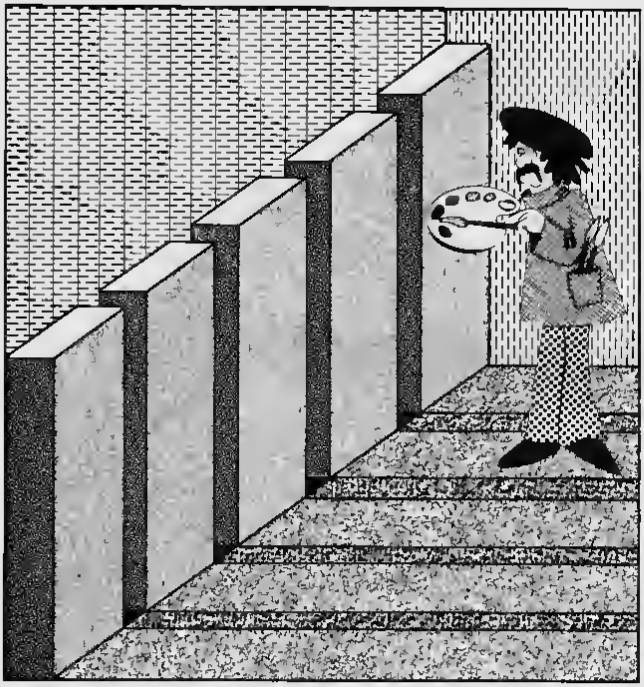
Essentially this is an excellent unit The biggest advantage of this system over others is that it is supplied as a package This is bound to prove attractive to potential buyers as it can be purchased connected and used immediately It has proved reliable and a tremendous improvement over the microdrives both in reliability of storage of files and in speed of access Loading and saving of files is almost instantaneous, comparisons with similar units is not really worthwhile as because the times are so small differences are academic

The disks themselves are more robust than the more common 5 25" type and therefore more reliable and less likely to suffer damage Against the system is the fact that specific drives must be used and the most common 40 track 5 25" is unsuitable This means that if you already possess one it is unusable Also the availability of 3 5" disks is not as widespread as the 5 25" kind and they are much more expensive (approx £5.00 compared with £2 00 £3 00)

A further problem which I was unaware of until I went to buy one is that there is no 3 5" standard format The one I bought would not fit into the drive! So if you want an off the peg system this one is ideal but if you want equipment which allows more flexibility — such as additional memory and parallel printer port — then you may well look at something like the Technology Research Interface reviewed elsewhere in this issue

Screen Master

For those of you wary of attempting our machine code graphics series, Matthew Probert presents a powerful screen artist program in BASIC.



Screen Master is a graphics design system for the 48K Spectrum or Spectrum+. It enables the user to quickly and simply design and save screens which may be used as title pages for programs during loading or used within programs themselves by extracting the short machine code routine used by Screen Master to display a screen instantaneously.

Terminology

Within these instructions certain terms will be used which should be understood. These are as follows:

Display: refers to the design on the TV screen.
Editor or Block cursor: a two character square block which may be moved around the display under user control.
Menu: refers to the Select Option state with the display showing the design being worked upon and the program waiting for the user to press a key.
Pixel cursor: refers to a single pixel cursor which may be moved around the display under user control.
Prompt: refers to a message displayed indicating that the user should press a key, ie Select option is a prompt.
Request: like prompt but indicates that some data should be entered by the user.
Screen: refers to a section of Ram holding the data of the design being worked upon.
Text: refers to characters which may be displayed in Print fashion.

Functions

Screen Master provides the user with eight different types of function for the display and manipulation of screen data. These functions are:

Pixel functions: which operate basically upon single pixels.
Block functions: which operate upon a block of data and tend to use the Editor cursor.
Screen functions: which operate upon screens of data.
Tape functions: which use the cassette recorder.
Attr functions: which change attributes.
Text functions: which manipulate text.
Brush functions: which provide various shading effects.
Status functions: which alter or display the current status of the system.

Pixel functions

There are seven pixel functions: Freehand, Circle, Ellipse, Box, Move and two others, Move and Erase, which are only accessed from Freehand.

There are then three functions relating to Freehand: these plot points, move the pixel cursor and erase points respectively. From one function to another within Freehand the user may select either one of the other Freehand functions by pressing keys P, M and E respectively or exit back to the Menu by pressing Enter. The Freehand function is selected from the Menu by key F.

When in Freehand mode the pixel cursor, like all other cursors, may be moved around the display by the cursor keys or keys 5 to 8. During Freehand in all of its functions the coordinates of the pixel cursor X,Y are displayed at the bottom of the display to aid the user.

The next three pixel functions, Circle, Ellipse and Box are selected by keys C, E and X respectively from the Menu. Each function requests an input from the user: for Circle this input is the radius of the circle in

pixels to be drawn with the coordinate X Y as the centre of the circle. If 0 is entered as the radius the system will return to the Menu. Ellipse requests both the radius in the X and Y axis of the ellipse to be drawn. Entering 0 for the X radius will again return the user to the Menu, otherwise an ellipse will be drawn with the coordinates X Y of the pixel cursor as its centre. Box works in a similar fashion but draws a rectangle to the right and down from the pixel cursor, so that the coodinates X Y form the top left corner of the shape. Entering a negative value in response to Length will result in the rectangle being drawn to the left, and a negative value for height will result in it being drawn up.

Pixel function Move, as selected from the Menu by key L, allows the user to move two cross lines around the screen at a rate of eight pixels per move. Upon exiting from this function the pixel cursor will be set to the coordinates at which the cross lines intersect.

Block functions

There are eight block functions, two of which use a special designer grid and these will be considered first.

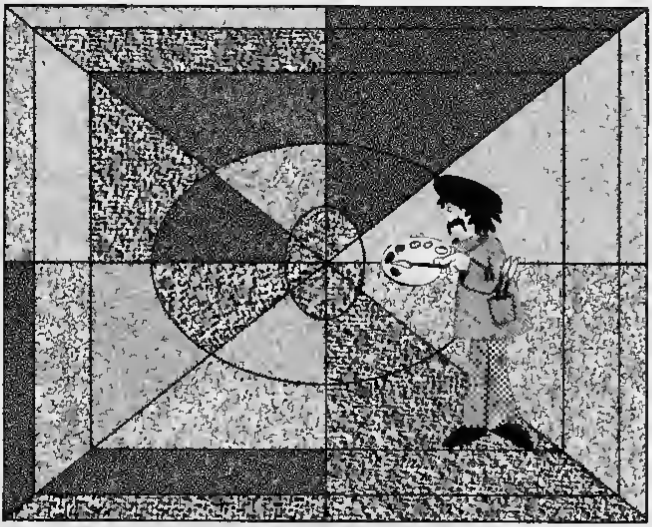
Sprite, selected by key S, allows the user to design a two by two character block on a large grid, a bit like a UDG generator. The cursor on the grid may be moved in three ways, with the cursor keys or keys 5 to 8 as usual, and also with symbol shift and keys 5 to 8 together, in which case it will leave a trail of filled in squares behind it. Single squares may be filled with key 9 and deleted with key 0.

Alter, selected by key A, is similar to Sprite, but picks up a two character square block of the screen, removes it from the display and transfers it to the grid ready for alterations to take place.

Reflect, switches the data on either side of the Editor cursor either on top to bottom or left to right depending upon whether X or Y was entered in response to the request respectively. Reflect is selected by key R.

Delete, selected by key DEL, erases the data below the Editor cursor from the display and screen.

Copy, is the same as Alter, but merely allows a copy of the data to be reproduced elsewhere without erasing the original. Copy is selected by key U.



Switch, selected by key H, changes the attributes under the Editor cursor to the current values.

Fill, selected by key N, fills in the area under the cursor as a solid block.

Zap, selected by key Z, changes the data under the cursor in a random way so as to give the impression that the data has been 'zapped'.

In all cases Enter should be used to exit from the move cursor routine, and Y or N pressed in response to the Okay? message. Pressing N reverts the display and screen back to how it was before the operation took place.

Screen functions

There are three screen functions, the first, Cls, selected by pressing EDIT, clears the display, having first transferred the display into the current screen, this pressing EDIT twice consecutively will also clear the current screen as well as the display.

The second function, Down, selected by key W, copies the screen to the display.

The last function, Merge, selected by key M, requests a screen number to be pressed and then overlays this screen on

```
Program 1
Type in this program and save on
tape, then type in the main prog
and save after this one using
LINE 1

   1 DATA 33,0,64,17,87,228,1,19
2,26,237,176,201,33,87,228,17,0,
64,1,192,26,237,176,201
   2 FOR N=0 TO 23: READ a: POKE
 23296+n,a: NEXT N
   3 DATA 33,0,88,62,22,6,32,54,
5,35,16,251,61,254,0,32,244,201,
1,0,27,33,87,147,17,0,64,126,254
,0,40,1,18,35,19,11,120,177,200,
24,242
   4 FOR I=23320 TO 23360: READ
A: POKE 1,A: NEXT I
   5 DATA 170,255,170,255,170,25
5,170,255,170,170,170,170,170,17
0,170,170,90,165,90,165,90,165,9
0,165
   6 DATA 255,0,255,0,255,0,255,
0,170,0,85,0,170,0,85,0,170,85,1
70,85,170,85,170,85,255,129,129,
129,129,129,129,129,255
   7 FOR N=0 TO 55: READ A: POKE
 USR "o"+N,A: NEXT N
  10 LOAD ""
```

top of the display in such a way that the new screen takes preference over the old but leaves the attributes alone

Tape functions

There are just two tape functions: Save and Load both of which operate using SCREEN$ and either save the display or load in the display and current screen. They are selected by Symbol Shift and either S or J respectively

Attr functions

There are four Attr functions the first Ink selected by key I changes the current ink colour Paper selected by key P changes the paper colour and Bright selected by key B switches the brightness from on to off and from off to on automatically. All three of these work in 'temporary' fashion

The last function Chg is selected by key O and changes the entire display and screen to the attribute value entered, it does not clear the display

Text functions

There is one text function selected by pressing key " it allows up to thirty two characters at a time to be displayed anywhere on the display and screen. The text may be graphics, selected by pressing the graphics key followed by entry of the required text or ordinary characters

The text may be displayed in inverse by pressing the INV Video key or made to flash by pressing extend followed by CAPS shift and key 9 together If you wish to exit the routine pressing Q whilst in the Move cursor stage will return you to the Menu

Brush functions

Six different brushes are provided selected by keys 1 to 6 from the Menu The brush function works like a cross between the text and Freehand functions described earlier

Status functions

There are two status functions Status which is selected by pressing key K and displays the current ink paper bright screen number and pixel cursor coordinates values and Addr which is selected by key T and allows the user to change screens between 1 and 4

Technical details

The four screens are each 6848 bytes long and stored at addresses 58519 51671 44823 and 37975 respectively The routine to copy the display into screen n is at address 23296 with the screen address held in bytes 23300 and 23301 The routine is relocatable

The routine to copy a screen to the display is at address 23308 with the screen address held in bytes 23309 and 23310 This routine is also relocatable

The program uses seven UDG's from O to U respectively Ramtop is automatically reset to below screen 4 so that NEW does not affect the screens in this way screens may be saved as Data by, Pressing BREAK to break into Screen Master Typing NEW to lose Screen Master and either loading in your own program or saving the screen(s) as data

Program 2 Main program

```
   9 LET I=0: LET P=7: LET B=0:
LET A=0
  10 LET BL=0: LET X=128: LET Y=
88: LET X1=X: LET Y1=Y: LET Z=46
00: LET ST=23296: LET RT=23308:
LET PL=1: LET ZA=0
  15 LET G=5
  20 POKE 23658,8
  30 PAPER 8: INK 6: BRIGHT 8
  40 LET YN=5700
  55 LET DEL=20: LET XR=0: LET Y
R=0
  60 OPEN #6,"K"
 100 CLS
 120 INPUT "": PRINT #6;TAB 9;"S
ELECT  OPTION"
 130 GO SUB Z
 150 LET G$=INKEY$
 160 IF G$="F" THEN  GO SUB 1500
 170 IF G$="D" THEN  GO SUB 1200
 180 IF G$="C" THEN  GO SUB 1600
 190 IF G$="E" THEN  GO SUB 1700
 200 IF G$="A" THEN  GO SUB 2800
 210 IF G$="R" THEN  GO SUB 3000
 220 IF G$="I" THEN  GO SUB 3100
 230 IF G$="P" THEN  GO SUB 3200
 240 IF G$="B" THEN  GO SUB 3300
 250 IF G$="X" THEN  GO SUB 1800
 260 IF CODE G$=7 THEN  INPUT ""
: RANDOMIZE USR 23296: GO TO 10
 270 IF G$="W" THEN  RANDOMIZE U
SR 23308
 280 IF G$="^" THEN  GO SUB 370
0
 290 IF G$="NOT " THEN  GO SUB 3
900
 300 IF G$="-" THEN  GO SUB 4000
 310 IF G$>"0" AND G$<"7" THEN
GO SUB 4100
 320 IF G$="O" THEN  GO SUB 4300
 330 IF G$="T" THEN  GO SUB 3600
 340 IF CODE G$=12 THEN  GO SUB
4500
 350 IF G$="S" THEN  LET BL=1: G
O SUB 2000: LET BL=0
 360 IF G$="H" THEN  GO SUB 4700
 370 IF G$="U" THEN  GO SUB 5000
 380 IF G$="Z" THEN  LET ZA=1: G
O SUB 5300
 390 IF G$="N" THEN  GO SUB 5500
 400 IF G$="K" THEN  GO SUB 5600
 410 IF G$="L" THEN  GO SUB 5800
 420 IF G$="N" THEN  GO SUB 6200
 430 GO TO 110
1000 INPUT "": PRINT #6;TAB 3;"X
:";X1;TAB 10;"Y:";Y1;"";TAB 17;"
X1:";X;TAB 24;"Y1:";Y
1005 IF CODE INKEY$=13 THEN  GO
TO 1005
1010 PLOT  OVER 1;X1,Y1
1020 LET G$=INKEY$
1030 IF (G$>="5" AND G$<="6") OR
 (CODE G$)=8 AND CODE G$<=11) TH
EN  GO TO 1050
1035 IF CODE G$=13 THEN  RETURN
1040 GO TO 1020
1060 LET X1=X1-(G$="5" OR CODE G
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$=8 AND X1>0)+(G$="8" OR CODE G$
=9 AND X1<255)
1070 LET Y1=Y1-(G$="6" OR CODE G
$=10 AND Y1>0)+(G$="7" OR CODE G
$=11 AND Y1<175)
1075 INPUT "": PRINT #G;TAB 3;"X
:";X1;TAB 10;"Y:";Y1;"";TAB 17;"
X1:";X;TAB 24;"Y:";Y1
1080 PLOT  OVER 1;PEEK 23677,PEE
K 23678
1085 PLOT  OVER 1;X1,Y1
1090 GO TO 1020
1105 INPUT "": PRINT #G;TAB 3;"X
:";X1;TAB 10;"Y:";Y1;TAB 17;"X1:
";X;TAB 24;"Y1:";Y
1110 PLOT  OVER 1;X,Y
1120 LET G$=INKEY$
1130 IF (G$>="5" AND G$<="8") OR
 (CODE G$>=8 AND CODE G$<=11) TH
EN  GO TO 1150
1135 IF CODE G$=13 THEN  RETURN
1140 GO TO 1120
1160 LET X=X-(G$="5" OR CODE G$=
8 AND X>8)+(G$="8" OR CODE G$=9
AND X<255)
1170 LET Y=Y-(G$="6" OR CODE G$=
10 AND Y>0)+(G$="7" OR CODE G$=1
1 AND Y<175)
1175 INPUT "": PRINT #G;TAB 3;"X
:";X1;TAB 10;"Y:";Y1;TAB 17;"X1:
";X;TAB 24;"Y1:";Y
1180 PLOT  OVER 1;PEEK 23677,PEE
K 23678
1185 PLOT  OVER 1;X,Y
1190 GO TO 1120
1200 INPUT TAB 0;"ANGLE OF ARC?
"; LINE Q$: IF Q$>="A" THEN  GO
TO 1200
1201 LET A=VAL Q$
1202 PRINT #G;TAB 14;"DRAW"
1203 PRINT  FLASH 1; OVER 1;AT 2
1-Y1/8,X1/8;" "
1204 PAUSE 100: PRINT  FLASH 0;
OVER 1;AT 21-Y1/8,X1/8;" "
1205 IF CODE INKEY$=13 THEN  GO
TO 1205
1210 GO SUB 1000
1217 PRINT  FLASH 1; OVER 1;AT 2
1-Y/8,X/8;" "
1218 PAUSE 100: PRINT  FLASH 0;
OVER 1;AT 21-Y/8,X/8;" "
1219 IF CODE INKEY$=13 THEN  GO
TO 1219
1220 GO SUB 1100
1230 DRAW  INK I; PAPER P; BRIGH
T B;X1-X,Y1-Y,A
1240 GO SUB YN
1260 IF INKEY$="Y" THEN  RANDOMI
ZE USR ST: RETURN
1270 PLOT  OVER 1;X,Y: DRAW  INK
 I; PAPER P; BRIGHT B; OVER 1;X1
-X,Y1-Y,A
1280 GO TO 1200
1500 INPUT "": PRINT #G;TAB 12;"
FREEHAND"
1505 IF INKEY$<>"" THEN  GO TO 1
505
1510 PLOT  OVER 1;X,Y
1520 LET G$=INKEY$
1525 IF G$="N" THEN  LET PL=0: I
NPUT "": PRINT #G;TAB 13;"MOVE":
 IF NOT POINT (X,Y) THEN  PLOT
OVER 1;X,Y
1526 IF G$="P" THEN  LET PL=1: I
NPUT "": PRINT #G;TAB 10;"FREEHA
ND"
1527 IF G$="E" THEN  LET PL=2: I
NPUT "": PRINT #G;TAB 13;"ERASE"
1530 IF (G$>="5" AND G$<="8") OR
 (CODE G$>=8 AND CODE G$<=11) TH
EN  GO TO 1550
1532 IF (CODE G$=13 AND (X=128 A
ND Y=88) OR PL=0) THEN  PLOT  OV
ER 1;PEEK 23677,PEEK 23678
1535 IF CODE G$=13 THEN  RETURN
1540 GO TO 1510
1550 IF PL=1 THEN  PLOT  INK I;
PAPER P; BRIGHT B;X,Y
1551 IF PL=0 THEN  PLOT  OVER 1;
X,Y
1552 IF PL=2 AND POINT (X,Y)=1 T
HEN  PLOT  OVER 1;X,Y
1555 LET X=X-(G$="5" OR CODE G$=
8 AND X>8)+(G$="8" OR CODE G$=9
AND X<255)
1560 LET Y=Y-(G$="6" OR CODE G$=
10 AND Y>0)+(G$="7" OR CODE G$=1
1 AND Y<175)
1566 INPUT "": PRINT #G;TAB 10;"
X:";X;TAB 17;"Y:";Y
1567 IF PL=2 AND POINT (X,Y)=1 T
HEN  PLOT  OVER 1;X,Y
1570 GO TO 1510
1600 INPUT TAB 10;"RADIUS "; LIN
E Q$: IF Q$>="A" THEN  GO TO 160
0
1610 LET R=VAL Q$: IF NOT R THEN
  RETURN
1620 IF X+R>255 OR X-R<0 OR Y+R>
175 OR Y-R<0 THEN  RETURN
1630 CIRCLE  INK I; PAPER P; BRI
GHT B;X,Y,R
1640 GO SUB YN
1660 IF INKEY$="Y" THEN  RANDOMI
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ZE USR ST: RETURN
1675 RANDOMIZE USR RT
1680 GO TO 1600
1750 INPUT TA$ 9;"X RADIUS "; LI
NE Q$: IF Q$>="A" THEN  GO TO 17
00
1715 LET XR=VAL Q$: IF NOT XR TH
EN  RETURN
1725 INPUT TA$ 9;"Y RADIUS "; LI
NE R$: IF Q$>="A" THEN  GO TO 17
20
1725 LET YR=VAL Q$
1730 IF X+XR>255 OR X-XR<0 OR Y+
YR>175 OR Y-YR<0 THEN  RETURN
1740 LET NA=XR*YR: IF NA>3000 TH
EN  LET NA=1: GO TO 1755
1745 LET NA=2
1755 FOR N=1 TO 720/NA
1765 PLOT  INK I; BRIGHT B; PAPE
R P;X+XR*COS (N/(360/NA)*PI),Y+Y
R*SIN (N/(360/NA)*PI)
1770 NEXT N
1780 GO SUB YN
1783 IF INKEY$="Y" THEN  RANDOMI
ZE USR ST: RETURN
1784 RANDOMIZE USR RT: GO TO 175
0
1800 INPUT "LENGTH "; LINE Q$: I
F Q$>="A" THEN  GO TO 1800
1810 LET L=VAL Q$: IF NOT L THEN
  RETURN
1820 INPUT "HEIGHT "; LINE Q$: I
F Q$>="A" THEN  GO TO 1820
1825 LET H=VAL Q$
1830 IF X+L>255 OR Y-H<0 THEN  R
ETURN
1840 PLOT  INK I; PAPER P; BRIGH
T B;X,Y: DRAW  INK I; PAPER P; B
RIGHT B;L,0: DRAW  INK I; PAPER
P; BRIGHT B;0,-H: DRAW  INK I; B
RIGHT B; PAPER P;-L,0: DRAW  INK
 I; BRIGHT B; PAPER P;0,H
1850 RETURN
2000 POKE 23728,X: POKE 23729,Y
2002 GO SUB 3455
2003 LET AT=22528+C+32*R
2005 DIM Q(4)
2015 LET Q(1)=ATTR (R,C): LET Q(
2)=ATTR (R,C+1): LET Q(3)=ATTR (
R+1,C): LET Q(4)=ATTR (R+1,C+1)
2030 LET X1=C*8: LET Y1=175-R*8
2045 DIM B$(16,16)
2080 INPUT "": PRINT #G;TA$ 19;"
PLEASE WAIT"
2096 IF BL=1 THEN  FOR N=1 TO 16
: LET B$(N)="□□□□□□□□□□□□□□□□":
NEXT N: GO TO 2175
2100 FOR Y=0 TO 15
2105 LET Y1=(175-R*8)-Y
2116 FOR X=0 TO 15
2120 LET X1=C*8+X
2135 IF POINT (X1,Y1)=1 THEN  LE
T B$(X+1,Y+1)="■": PLOT  OVER 1;
X1,Y1: GO TO 2150
2140 IF POINT (X1,Y1)=0 THEN  LE
T B$(X+1,Y+1)="□"
2156 NEXT X
2166 NEXT Y
2162 IF ZA THEN  GO TO 5365
2164 RANDOMIZE USR ST
2165 IF YR THEN  GO SUB 2800: GO
 TO 2500
2166 IF XR THEN  GO SUB 2700: GO
 TO 2500
2170 CLS
2180 FOR N=1 TO 16
2190 FOR M=1 TO 16
2200 PRINT AT N,M;B$(M,N)
2210 NEXT M
2220 NEXT N
2235 PRINT AT 1,19;"MOVE WITH";A
T 3,19;"CURSOR KEYS";AT 5,19;"FI
LL WITH 9";AT 7,19;"DEL WITH 0";
AT 9,19;"ENTER TO END"
2240 LET A=1: LET AA=1
2255 PRINT  OVER 1; FLASH 1;AT A
,AA;"X"
2260 LET G$=INKEY$
2270 IF G$="" THEN  GO TO 2260
2285 BEEP .01,20
2290 IF G$="9" OR G$="(" OR G$="
'" OR G$="&" OR G$="%" THEN  PRI
NT AT A,AA;"■": LET B$(AA,A)="■"
2295 PRINT AT A,AA;B$(AA,A)
2306 IF G$="6" THEN  PRINT AT A,
AA;"□": LET B$(AA,A)="□"
2315 LET AA=AA+(G$="8" OR CODE G
$=9 OR G$="(" AND AA<16)-(G$="5"
 OR CODE G$=8 OR G$="%" AND AA>1
)
2320 LET A=A+(G$="6" OR CODE G$=
10 OR G$="&" AND A<16)-(G$="7" O
R CODE G$=11 OR G$="'" AND A>1)
2325 IF AA>16 THEN  LET AA=16
2326 IF A>16 THEN  LET A=16
2327 IF A<1 THEN  LET A=1
2328 IF AA<1 THEN  LET AA=1
2335 IF CODE G$=13 THEN  GO TO 2
500
2340 GO TO 2250
2506 CLS : RANDOMIZE USR RT
2567 INPUT "": PRINT #G;TA$ 9;"S
AME PLACE?"
2568 IF INKEY$<>"Y" AND INKEY$<>
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"N" THEN  GO TO 2500
2509 IF INKEY$="Y" THEN  LET C1=
C: LET R1=R: GO TO 2515
2510 GO SUB 3400: LET R1=R: LET
C1=C
2511 LET AT=22528+C1+32*R1
2512 FOR N=0 TO 15
2513 LET Q(1)=ATTR (R1,C1): LET
Q(2)=ATTR (R1,C1+1): LET Q(3)=AT
TR (R1+1,C1): LET Q(4)=ATTR (R1+
1,C1+1)
2515 INPUT "": PRINT #G;TAB 10;"
PLEASE WAIT"
2516 FOR N=0 TO 15
2520 FOR M=0 TO 15
2530 IF B$(M+1,N+1)="■" THEN  PL
OT C1*8+M,(175-R1*8)-N
2540 NEXT M
2550 NEXT N
2560 POKE AT,Q(1): POKE AT+1,Q(2
): POKE AT+32,Q(3): POKE AT+33,Q
(4)
2562 IF ZA THEN  GO TO 5360
2563 RANDOMIZE USR ST
2564 LET X=PEEK 23728: LET Y=PEE
K 23729
2565 RETURN
2730 FOR M=1 TO 16
2740 FOR N=1 TO 7
2745 LET T$=B$(8+N,M)
2750 LET B$(8+N,M)=B$(N,M)
2755 LET B$(N,M)=T$
2760 NEXT N
2770 NEXT M
2790 RETURN
2830 FOR M=1 TO 7
2840 FOR N=1 TO 16
2845 LET T$=B$(N,8+M)
2850 LET B$(N,8+M)=B$(N,M)
2855 LET B$(N,M)=T$
2860 NEXT N
2870 NEXT M
2880 RETURN
3000 INPUT "    REFLECT ABOUT X
OR Y"; LINE B$
3010 IF B$<>"X" AND B$<>"Y" THEN
  GO TO 3000
3020 LET XR=B$="X"
3030 LET YR=B$="Y"
3040 GO TO 2000
3100 INPUT "": PRINT #G;"  PRESS
 0 TO 9 FOR  INK COLOUR"
3110 IF INKEY$<>"" THEN  GO TO 3
110
3120 IF INKEY$<"0" OR INKEY$>"9"
 THEN  GO TO 3120
3130 LET I=VAL INKEY$
3140 RETURN
3200 INPUT "": PRINT #G;" PRESS
0 TO 9 FOR  PAPER COLOUR"
3210 IF INKEY$<>"" THEN  GO TO 3
210
3220 IF INKEY$<"0" OR INKEY$>"9"
 THEN  GO TO 3220
3230 LET P=VAL INKEY$
3240 RETURN
3300 LET B=0
3310 RETURN
3400 LET R=10: LET C=15
3410 PRINT  OVER 1;AT R,C;"  ";A
T R+1,C;"  "
3420 INPUT "": PRINT #G;TAB 4;"M
OVE SQUARE TO POSITION"
3430 LET G$=INKEY$
3435 IF CODE G$=13 THEN  PRINT
OVER 1;AT R,C;"  ";AT R+1,C;"  "
: RETURN
3437 IF G$="G" THEN  RETURN
3440 IF G$="" THEN  GO TO 3430
3450 LET R1=R+(G$="6" OR CODE G$
=10 AND R<20)-(G$="7" OR CODE G$
=11 AND R>0)
3460 LET C1=C+(G$="8" OR CODE G$
=9 AND C<31)-(G$="5" OR CODE G$=
8 AND C>0)
3470 PRINT  OVER 1;AT R,C;"  ";A
T R+1,C;"  "
3480 LET R=R1: LET C=C1
3490 PRINT  OVER 1;AT R,C;"  ";A
T R+1,C;"  "
3500 GO TO 3430
3610 INPUT "": PRINT #G;TAB 8;"S
ELECT 1 TO 4"
3620 IF INKEY$<>"" THEN  GO TO 3
620
3630 IF INKEY$<"1" OR INKEY$>"4"
 THEN  GO TO 3630
3635 LET G$=INKEY$
3640 LET S=65367-VAL G$*6848
3650 POKE 23300,S-256*INT (S/256
): POKE 23301,INT (S/256): POKE
23309,PEEK 23300: POKE 23310,PEE
K 23301
3660 INPUT "": PRINT #G;TAB 10;"
SCREEN=";VAL G$
3670 GO SUB Z
3690 RETURN
3710 INPUT "TEXT "; LINE T$
3715 LET R=0: LET C=0: PRINT  IN
K 8; OVER 1; FLASH 1;AT R,C;"■"
3720 PRINT #5;"MOVE SQUARE TO RE
QUIRED POSITION"
3725 IF INKEY$<>"" THEN  GO TO 3
725
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3730 LET G$=INKEY$: IF G$="" THE
N  GO TO 3730
3740 IF CODE G$=13 THEN  GO TO 3
000
3750 PRINT  OVER 1; FLASH 0;AT R
,C;"■"
3760 LET R=R+(G$="6" OR CODE G$=
10 AND R<21)-(G$="7" OR CODE G$=
11 AND R>0)
3770 LET C=C+(G$="8" OR CODE G$=
9 AND C<31)-(G$="5" OR CODE G$=8
 AND C>0)
3780 PRINT  OVER 1; FLASH 1;AT R
,C;"■"
3790 GO TO 3730
3800 PRINT  INK I; BRIGHT B; PAP
ER P;AT R,C;T$
3810 GO SUB YN
3830 IF INKEY$="Y" THEN  INPUT "
": RANDOMIZE USR ST: RETURN
3835 INPUT ""
3840 RANDONIZE USR RT
3845 PRINT  OVER 1;AT R,C;"■"
3850 GO TO 3720
3905 DIM S$(10)
3910 INPUT "ENTER TITLE FOR SAVI
NG"; LINE S$
3915 RANDOMIZE USR ST: BORDER P:
 CLS : RANDOMIZE USR RT
3920 SAVE S$SCREEN$
3930 RETURN
4010 INPUT "ENTER TITLE FOR LOAD
ING"; LINE S$
4015 IF S$="              " THEN  LO
AD ""SCREEN$ : GO TO 4030
4020 LOAD S$SCREEN$
4030 RANDOMIZE USR ST: RETURN
4105 LET CH=164-VAL G$
4110 LET R=0: LET C=0
4120 PRINT  OVER 1;AT R,C;CHR$ C
H
4130 INPUT "": PRINT #G;"MOVE BR
USH TO REQUIRED POSITION "
4140 LET G$=INKEY$: IF G$="" THE
N  GO TO 4140
4145 PRINT  OVER 1;AT R,C;CHR$ C
H
4150 LET R=R+(G$="6" OR CODE G$=
10 AND R<21)-(G$="7" OR CODE G$=
11 AND R>0)
4160 LET C=C+(G$="8" OR CODE G$=
9 AND C<31)-(G$="5" OR CODE G$=8
 AND C>0)
4170 PRINT  OVER 1;AT R,C;CHR$ C
H
4180 IF CODE G$<>13 THEN  GO TO
4140
4190 INPUT "": PRINT #G;TAB 7;"M
OVE BRUSH TO PAINT"
4195 GO SUB Z
4200 LET G$=INKEY$: IF G$="" THE
N  GO TO 4200
4220 LET R=R+(G$="6" OR CODE G$=
10 AND R<21)-(G$="7" OR CODE G$=
11 AND R>0)
4230 LET C=C+(G$="8" OR CODE G$=
9 AND C<31)-(G$="5" OR CODE G$=8
 AND C>0)
4232 PRINT  INK I; PAPER P; BRIG
HT B;AT R,C;CHR$ CH
4235 INPUT "": PRINT #G;TAB 8;"R
OW ";R;TAB 18;"COLUMN ";C
4240 IF CODE G$=13 THEN  INPUT "
": RANDOMIZE USR ST: RETURN
4250 GO TO 4200
4310 INPUT "ENTER REQUIRED ATTR
VALUE";A
4320 IF A>255 OR A<0 THEN  GO TO
 4310
4330 POKE 23328,A
4340 RANDOMIZE USR 23320
4345 IF A>127 THEN  LET A=A-128
4346 IF A>63 THEN  LET A=A-64: L
ET B=1
4350 LET P=INT (A/8): LET I=A-(I
NT (A/8)*8)
4360 RETURN
4510 GO SUB 3400
4520 PRINT AT R,C;"  ";AT R+1,C;
"  "
4530 GO SUB YN
4540 IF INKEY$="Y" THEN  INPUT "
": RANDOMIZE USR ST: RETURN
4550 GO SUB 3410
4560 GO TO 4520
4600 IF INKEY$<>"" THEN  GO TO 4
600
4610 IF INKEY$="" THEN  GO TO 46
10
4620 RETURN
4700 GO SUB 3400
4710 PRINT  PAPER P; INK I; OVER
 1; BRIGHT B;AT R,C;"  ";AT R+1,
C;"  "
4720 RETURN
5010 GO SUB 3400
5020 DIM B$(16,16)
5030 INPUT "": PRINT #G;TAB 10;"
PLEASE WAIT"
5040 FOR Y=0 TO 15
5050 LET Y1=(175-R*8)-Y
5060 FOR X=0 TO 15
5070 LET X1=C*8+X
5080 IF POINT (X1,Y1) THEN  LET
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B$(X+1,Y+1)="■"
5090 IF NOT POINT (X1,Y1) THEN
LET B$(X+1,Y+1)="□"
5100 NEXT X
5110 NEXT Y
5120 INPUT "": GO SUB 3400
5130 LET C1=C: LET R1=R
5140 INPUT "": PRINT #G;TAB 10;"
PLEASE WAIT"
5150 FOR N=0 TO 15
5160 FOR M=0 TO 15
5170 IF B$(M+1,N+1)="■" THEN  PL
OT  INK I; PAPER P; BRIGHT B;C1*
8+M,(175-R1*8)-N
5180 NEXT M
5190 NEXT N
5200 RANDOMIZE USR ST
5210 RETURN
5300 GO TO 2000
5302 POKE 23670,PEEK 23673: POKE
 23671,PEEK 23672
5305 FOR N=0 TO 20+INT (RND*40)
5310 LET R2=INT (RND*16)+1: LET
C2=INT (RND*16)+1
5320 IF B$(R2,C2)="■" THEN  LET
B$(R2,C2)="□": GO TO 5340
5330 LET B$(R2,C2)="■"
5340 NEXT N
5350 GO TO 2507
5360 GO SUB YN
5375 LET ZA=0
5377 LET X=PEEK 23728: LET Y=PEE
K 23729
5380 IF INKEY$="Y" THEN  RANDOMI
ZE USR ST: RETURN
5390 RANDOMIZE USR RT
5400 RETURN
5500 INPUT "": PRINT #G;TAB 8;"S
ELECT 1 TO 4"
5510 IF INKEY$<>"" THEN  GO TO 3
620
5520 IF INKEY$<"1" OR INKEY$>"4"
 THEN  GO TO 5520
5525 LET G$=INKEY$
5530 LET S=65367-VAL G$*6912
5540 POKE 23342,S-256*INT (S/256
): POKE 23343,INT (S/256)
5550 RANDOMIZE USR 23338
5580 RETURN
5600 CLS
5610 PRINT AT 5,13;"STATE": PRIN
T ''TAB 11;"INK.....";I: PRINT
TAB 11;"PAPER...";P: PRINT 'TAB
11;"BRIGHT..";: PRINT ("ON" AND
B=1)+("OFF" AND B=0)
5620 PRINT 'TAB 11;"SCREEN #";
5630 LET S=PEEK 23300+256*PEEK 2
3301: LET S=65367-S: LET S=S/691
2
5640 PRINT S
5645 PRINT 'TAB 11;"X,Y.....";X;
",";Y
5650 GO SUB 2: CLS : RANDOMIZE U
SR RT: RETURN
5700 INPUT "": PRINT #G;TAB 13;"
OKAY?"
5710 IF INKEY$<>"Y" AND INKEY$<>
"N" THEN  GO TO 5710
5720 RETURN
5800 INPUT "": PRINT #G;"   MOVE
 CROSS LINES TO POSITION"
5860 LET X=128: LET Y=88
5870 GO SUB 6100
5800 INPUT "": PRINT #G;"   MOVE
 CROSS LINES TO POSITION"
5860 LET X=128: LET Y=88
5870 GO SUB 6100
5880 LET G$=INKEY$: IF G$="" THE
N  GO TO 5880
5890 IF G$>"8" THEN  GO TO 5880
5895 IF CODE G$=13 THEN  GO TO 6
130
5900 GO SUB 6100
6010 LET X=X+(8 AND (G$="8" OR C
ODE G$=9 AND X<248))-(8 AND (G$=
"5" OR CODE G$=8 AND X>7))
6020 LET Y=Y+(8 AND (G$="7" OR C
ODE G$=11 AND Y<167))-(8 AND (G$
="6" OR CODE G$=10 AND Y>7))
6040 GO TO 5870
6100 PLOT  OVER 1;X,175: DRAW  O
VER 1;0,-175: PLOT  OVER 1;0,Y:
DRAW  OVER 1;255,0
6120 RETURN
6130 GO SUB YN
6140 IF INKEY$="N" THEN  INPUT "
": PRINT #G;"   MOVE CROSS LINES
 TO POSITION": GO TO 5880
6150 RANDOMIZE USR RT
6160 RETURN
6200 GO SUB 3400
6205 IF G$="9" THEN  RANDOMIZE U
SR RT: RETURN
6210 PRINT  INK I; PAPER P; BRIG
HT B;AT R,C;"■■";AT R+1,C;"■■"
6220 GO SUB YN
6230 IF INKEY$="N" THEN  RANDOMI
ZE USR RT: GO TO 6200
6235 RANDOMIZE USR ST
6240 INPUT "": PRINT #G;TAB 10;"
 CONTINUE ?"
6250 GO SUB 5710
6260 IF INKEY$="N" TNEN  RETURN
6270 GO TO 6200
```

Wise Moves

Michael Spencer shows us some ways of getting things moving around the screen.

Animation is the process that puts life into computer games but has far wider uses. The ability of a computer to create, move and display visual information has only reached the home market fairly recently, and is becoming a very popular and interesting application for users at all levels.

Computer graphics is a term that means different things to different people but generally covers images that are computer generated, modified, stored and displayed but need not necessarily be animated. To a businessman graphics means histograms, graphs and other methods of presenting financial information visually. To a railway signalman the mimic display showing train moves is a form of computer graphic to a student pilot on an aircraft simulator the realistic images are computer generated. Computer aided design perhaps involves the most complicated imagery of all: think about car design as an example. A good deal of computer graphics is merely static images that can be displayed when required. Animation is the art of making those images appear to move in such a way that the impression of a lifelike object is created. Animation is an art that predates the computer revolution by quite a long time and its application is a practised skill. Cartoons are a much loved example of film animation and such films have given pleasure to millions but few of these millions have ever given much thought to the sheer effort involved in producing those cartoons. In one second of film there will be twenty four frames and each frame is an individual picture showing a stage in the motion of the animated object. It doesn't take much mental arithmetic to work out how many individual pictures there are likely to be in a ten minute cartoon feature.

Cartoons are an example of drawn animation that uses the skill of an animator to draw a sequence of individual pictures which, when filmed, give the impression of motion. There are other techniques of animation: model, cutout and rostrum (controlled camera) animation are examples. These techniques are more suitable to the use of computers to aid such activity. drawn animation is more directly applicable to using computers to replace manual techniques and thid is the main topic of discussion here.

Animators in the film industry are skilled people and the success of the work depends on their grasp of two factors timing and realism. Correct timing can convey the impression of animation well and that timing ought to reflect the behaviour in the real world of the object being animated. Realism ensures that the object and its behaviour reflect the laws of motion and the presence of gravity. These techniques have been built up over many years and it is only their application in the use of computers that is new — the computer screen is only another medium on which to display images (it may be called electronic paper). The computer may also be a means to an end. computers as animators tools are having an impact on the film industry. Remember the Walt Disney film TRON about a computer programmer and his battle against a wayward super computer? A good deal of that film was made by using computer animation and still graphics — a novel approach that created a stunning impact. Computers can take the tedium out of the process of producing images for animation — a single image can be manipulated to a new position, size or shape by applying mathmatical routines. Taken to an extreme it may be possible to produce a complete film in a few years time and indeed a Hollywood film company is using a CRAY super computer to cope with the fantastic number of calculations involved in such processes. This machine made its debut code cracking in American for the Government and has since made contributions in many other fields.

Animation itself involves three basic processes — preparation of the image, manipulation and display. It is the manipulation that is at the heart of the technique of animation. The computer offers the electronic paper for us to exploit and the characteristics of that paper determine what sort of animation is possible. There are three sorts of graphics that can be created on most home computers — block, pixel and line graphics. Block graphics involve the use of character sized shapes (see the top row of the Spectrum keyboard) which may be used individually or as part of larger shapes which can be moved around the screen. The program in figure one creates such a shape and moves it around. The program is reasonably effective and shows some of the basics of simple animation. An image drawn on the screen is erased and a new image created in a different place which gives the appearance of motion. A variation of the technique would be to surround the image with blank characters to erase parts of the old image at each move. If no blanking took place — using either method — then the effect would be spoiled by the image leaving a visible trail. the image is being drawn and redrawn to the same piece of electronic paper. The technique is summed up as draw, wait, erase and redraw. Block graphics are useful but a little boring, so fortunately we have access to pixel graphics.

```
10 REM BLOCK GRAPHIC ANIMATION
20 CLS
30 LET A$="▚▞"
40 LET B$="  "
50 FOR I=0 TO 21
60 PRINT AT I,12;A$
70 PAUSE 5
80 PRINT AT I,12;B$
90 NEXT I
100 GO TO 50
```

Figure 1

Pixels

Pixel graphics are much simpler for they are single points on the screen that can be turned on and off and most importantly their state may be tested. Pixel graphics introduce the idea of resolution — the higher the resolution (the number of pixels in a given area) the better the image. The Sinclair Spectrum has a very reasonable resolution of 176 by 256 pixels each of which can be individually set and tested. In case of a single pixel being moved around the screen the technique is similar to block graphics: the pixel is set and unset (erased) and moved to a new position after appropriate delay. Groups of pixels make up the high resolution screens that form the bulk of a computer games attractions. These shapes can be animated by dealing with the individual pixels that make them up. Collision detection is a computer inspired technique where the collision between two objects on the screen can be detected and the appropriate action taken. Shapes can be made to rebound from obstacles: a method used to great effect in bat and ball games. Collisions can lead to explosions which is again a widely used technique in the most popular arcade games. The program in figure two illustrates pixel animation and collision detection.

Some computers support Sprite graphics unfortunately the Spectrum does not although some users have managed to write interrupt driven software that gives a fair implementation of this feature which is normally supported by a dedicated chip. A Sprite is a shape that is defined and moved around the screen by dedicated software and usually supports full collision detection. The program in figure two has simple

collision detection where the place the pixels will occupy next is tested to see if it s possible to move there A realist c rebound is programmed in rather than a straight reversal of course if a coll sion is detected

Lines

Line graphics can be the most satisfy ng because they can be used to make up wire images of objects giving a three dimen sional effect That object can be moved realistically around the screen and even rotated around various po nts Wire images have been used in some com puter games but are probably best known in such applications as building and car design The program in f gure 3 is an exam ple These are the three main ways of producing graphics on most home computers and for tunately we have access to all three on the Sinclair Spectrum It has to be said that the best animation on the Spectrum will be written using machine code rather than BASIC because machine code is a good deal faster BASIC is easy to unders tand and has been used in the examples here for clarity though t can cause flickering and other odd effects and detra t from the effect that you are trying to achieve

The actual process of anima t on on computers s a good deal different from that using hand drawn images and film A com puter really only undertands numbers so that images shown have to be digitised to coor dinates and these coord nates manipulated to produce new im ages in different positions Do that quickly enough and you have an mation In extreme cases a single drawing may be made and many different im ages made by mathem at cal manipulation For example an image may be made wider or taller by altering values along one axis give a computer two images one bigger than the other and the computer can be programmed to produce a new image between the two sizes — this is known as an in between ng Animation mplies change so that images presented sequentially appear to move The basis of animation involves a number of key elements that help produce the dsired effect The obvious is change in size or shape others nclude change n speed angle colour position and perspective — remember these are anima t on techniques and not com puter techniques We have all seen some really funny cartoons where some of the humour has been about the ability of a character or object to survive impossibly destructive situa tions — for example holding a bomb when it goes off being squashed flat or stretched Twist skew shear bend and explode can all be used to great effect Explosions seem to characterise the even popular arcade game and it is worth knowing how to do this

Bang!

The basis of an explosion effect is that the image breaks up and moves apart from a central point The image is initially chop ped or minced into short lines or pieces and these move radially out from a central point Most explosions are a variation of this for example the bits of the ex ploded image can be made to tumble flicker or leave trailing images as t moves apart The image may be exploded nto single pixels that change colour rapidly as they move outwards A computer can generate useful sound effects to accompany th s v sual extravaganza which makes the whole process more effective

Manipulation in size is one technique that a computer can do quickly without the need for new images to be drawn digitis ed and stored It is simply a matt ter of arithmetic to alter the size of an object For example characters can be made larger by scanning the character square and reproducing the im age larger or smaller The pro grame is figured four does this four one character and d splays an image twice the size at a dif ferent place on the screen It ach eves th s by scanning all the sixty four pixels in the character square and displaying them doubled up on both axis It is a simple matter to adapt this pro gram to reproduce a character that is stretched taller or wider by only adjusting the values on one or the other axis This technique because it works at the pixel level will also expand any shape In BASIC it s rather slow in machine code it is much faster and can be used to great effect

Perhaps the most exciting possibility for a home computer user is to make use of line graphics and produce a three dimensional representation of an object that can be rotated in any given direction and create some illusion of movement The wire frame image depends on coordinate geometry to manipulate it It is a matter of numbers and few rules The big gest problem is that the televi s on or other computer screen is only two dimensional Perhaps one day hologram technology will have advanced enough so that three dimensional images can be projected into a living room like a super television but until then we must rely on the eye being fooled by two dimensional trickery Perspec tive drawings do this and the Renaissance artists were masters of the art and produced some remarkable paintings and drawings The keys to such works of art is the vanishing point Looking along railway lines the tracks appear to con verge at a point — this is a vanish ng point These drawings are made with reference to such a point which is often off the paper

3D

In three dimensional reality we can describe an object by reference to three axis x y and z as they are conventionally known When measuring an ob ject we normally described the dimensions in terms of length width and height but in order to describe an object in terms suitable for computer graphics we must describe the object in distances from an origin point The origin can be a corner of the object itself or further away the object may be viewed from the origin or another point The n tindness the idea of how we can ▶

```
  10 REM PIXEL GRAPHIC ANIMATION
  20 REM AND COLLISION DETECTION
  30 CLS
  40 REM DRAW BORDER
  50 FOR I=1 TO 20: PRINT AT I,1
;"■": PRINT AT I,30;"■"
  60 NEXT I
  70 FOR I=1 TO 30: PRINT AT I,1
;"■": PRINT AT 20,I;"■"
  80 NEXT I
  90 GO TO 220: REM MAIN PART
 100 REM PLOT SUBROUTINE
 110 PLOT X,Y
 120 PAUSE 4
 130 RETURN
 140 REM UNPLOT SUBROUTINE
 150 PLOT  OVER 1;X,Y
 160 RETURN
 170 REM COLLISION DETECTION
 180 REM SUBROUTINE
 190 IF POINT (X+XDIR,Y+YDIR)=1
AND POINT (X+XDIR,Y+YDIR+1)=1 AN
D POINT (X+XDIR,Y+YDIR-1)=1 THEN
  LET XDIR=XDIR*-1
 200 IF POINT (X+XDIR,Y+YDIR)=1
AND POINT (X+XDIR+1,Y+YDIR)=1 AN
D POINT (X+XDIR-1,Y+YDIR)=1 THEN
  LET YDIR=YDIR*-1
 210 RETURN
 220 REM MAIN LOOP
 230 LET X=70: LET Y=100: LET XD
IR=-3.1: LET YDIR=1
 240 GO SUB 170: REM COLLIDED?
 250 GO SUB 110: REM PLOT
 260 GO SUB 140: REM UNPLOT
 270 LET X=X+XDIR
 280 LET Y=Y+YDIR
 290 GO TO 240
```

Figure 2

```
  10 REM CUBOID DRAWING
  20 LET OX=50: LET OY=40
  30 LET A=30: LET B=40: LET C=1
5: LET D=20
  40 PLOT OX,OY
  50 DRAW 0,A: DRAW B,0: DRAW B,
-A: DRAW -B,0
  60 DRAW C,D: DRAW 0,B: DRAW -C
,-D
  70 PLOT OX+B,OY+A: DRAW C,D: D
RAW 0,0: DRAW -C,-D
  80 PLOT OX+C,OY+D: DRAW 0,A: D
RAW B,0: DRAW B,-A
  90 LET A=A+1: LET B=B+1: LET C
=C+1: LET D=D+1
 100 STOP
```

Figure 3

```
  10 REM DOUBLE SIZE CHARACTERS
  20 LET XC=1: LET YC=1
  30 PRINT AT 10,10;"A"
  40 DIM A(8,8)
  50 REM SCAN CHARACTER
  60 FOR X=0 TO 7
  70 FOR Y=0 TO 7
  80 IF POINT (X+88,Y+88)=1 THEN
  LET A(X+1,Y+1)=1
  90 NEXT Y
 100 NEXT X
 110 REM REPRODUCE ENLARGED
 120 FOR X=1 TO 16
 130 FOR Y=1 TO 16
 140 LET YC=INT (Y/2): IF YC=8 T
HEN  LET YC=1
 150 IF A(XC,YC)=1 THEN  PLOT X+
96,Y+84
 160 LET XC=INT (X/2): IF XC=8 T
HEN  LET XC=1
 170 NEXT Y
 180 NEXT X
```

Figure 4

make a flat two dimensional representation appear three dimensional and provide the basis for animating such an object. The diagram in figure 5 shows how a single point viewed from the origin of the coordinates(x,y and z) can be represented on the picture plane at a set distance from the viewpoint. The picture plane of course is our television screen and the x and y coordinates of the point on it with respect to the bottom left hand corner are calculated as x times (distance of picture plane to viewpoint axis divided by z). This is called transforming and is good for any object where the viewpoint and the origin of the coordinate system are the same place.

Some degree of animation is now possible once the three dimensions are transformed into two on the picture plane. The x,y coordinates can be transformed around the screen — enlarged, reduced, moved or rotated and the perspective altered by shifting the picture plane. Rotation presents an interesting problem because one has to resort to sines and cosines to solve the shifting of x and y coordinates about the centre of rotation. Taking an anti clockwise rotation through a *specified angle A* then the new coordinates of the point x,y will be calculated as x cosine *A* y sine *A* for the x coordinate, and x sine *A* + y sine *A* for the y coordinate. This idea is incorporated

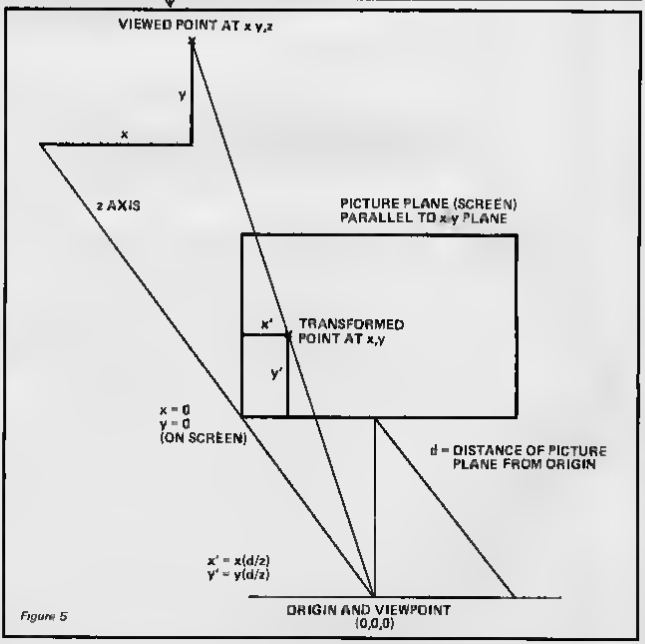
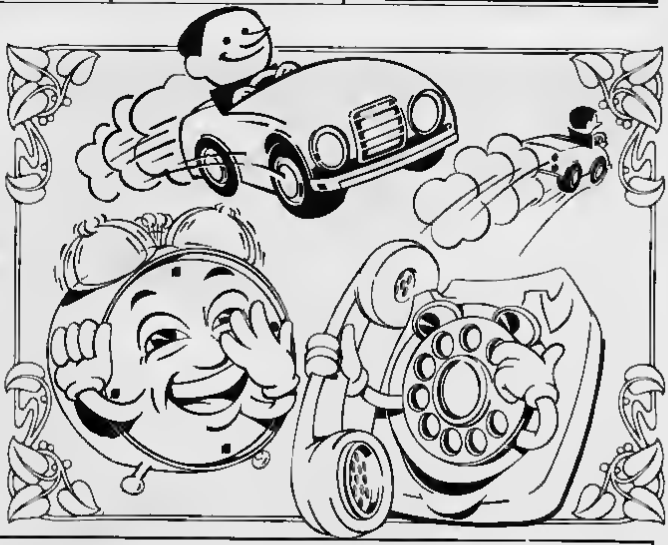


Figure 5

nto the program n figure 6 which dews a cube then rotates into a new posit on

Line graphics are particularly suitable for these sorts of transformation though it must be said that the mathematics can become quite complex when trying to view the object from any point other than the origin of the coordinate system Naturally for flicker free animation mach ne code is essential as there may be a large number of calculations involved n transforming each point on an object Combinations of block pixel and line graphics can be seen in many animated computer games as well as more serious applications but it must be said that really complex animation is the preserve of much larger and more expensive computers What is needed in the home computer market is dedicated software that will allow easy and fast animation by coping with the transformations necessary the software can be rather like the sprite graphics support available on a chip n some computers

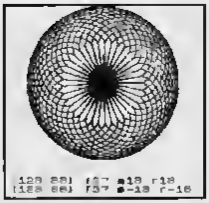


```
  10 REM SIMPLE ROTATION OF
  20 REM CUBOID SHAPE
  30 LET ANGLE=-.15: REM APPROX
10 DEGREES CLOCKWISE
  40 DIM X(8): DIM Y(8)
  50 REM COORDINATES
  60 DATA 80,20,80,110,120,110,1
20,80
  70 DATA 95,100,95,130,135,130,
135,100
  80 REM NOMINATE CENTRE OF
  90 REM ROTATION AT 100,110
 100 FOR I=1 TO 8
 110 READ X(I),Y(I)
 120 NEXT I
 130 GO SUB 190: REM PLOT SHAPE
 140 REM MAKE RELATIVE TO CENTRE
 150 FOR I=1 TO 8
 160 LET X(I)=X(I)-100: LET Y(I)
=Y(I)-110
 170 NEXT I
 180 GO TO 410: REM TO ROTATE
 190 REM DRAW CUBOID SUBROUTINE
 200 CLS
 210 PLOT X(1),Y(1)
 220 DRAW X(2)-X(1),Y(2)-Y(1)
 230 DRAW X(3)-X(2),Y(3)-Y(2)
 240 DRAW X(4)-X(3),Y(4)-Y(3)
 250 DRAW X(1)-X(4),Y(1)-Y(4)
 260 PLOT X(5),Y(5)
 270 DRAW X(6)-X(5),Y(6)-Y(5)
 280 DRAW X(7)-X(6),Y(7)-Y(6)
 290 DRAW X(8)-X(7),Y(8)-Y(7)
 300 DRAW X(5)-X(8),Y(5)-Y(8)
 310 PLOT X(4),Y(4)
 320 DRAW X(8)-X(4),Y(8)-Y(4)
 330 DRAW X(5)-X(8),Y(5)-Y(8)
 340 PLOT X(1),Y(1)
 350 DRAW X(5)-X(1),Y(5)-Y(1)
 360 PLOT X(2),Y(2)
 370 DRAW X(6)-X(2),Y(6)-Y(2)
 380 PLOT X(3),Y(3)
 390 DRAW X(7)-X(3),Y(7)-Y(3)
 400 RETURN
 410 REM APPLY ROTATION
 420 REM TO COORDINATES
 430 FOR I=1 TO 8
 440 LET X(I)=(X(I)*COS ANGLE)-(
Y(I)*SIN ANGLE)
 450 LET Y(I)=(X(I)*SIN ANGLE)+(
Y(I)*COS ANGLE)
 460 NEXT I
 470 REM CALCULATE SCREEN COORDS
 480 FOR I=1 TO 8: LET X(I)=X(I)
+100: LET Y(I)=Y(I)+110
 490 NEXT I
 500 GO SUB 190: REM PLOT AGAIN
 510 STOP
```

Figure 6

Spirogram

Moving in circles can produce some interesting results as Simon Palmer demonstrates.



Almost everybody will have played with a Spirograph at some time. It is a set of toothed wheels, like gears which produce intricate patterns. One of the gears is pinned to a piece of paper while the other is pushed around it by a pen which pokes through onto the paper. The patterns which are produced depend on the sizes the gears and the position of the pen hole in the moving gear. These effects are reproduced on a Spectrum computer by this program.

The format for a call to the machine code program is RANDOMIZE USR 65274 REM a,b,f,m,r where a and b are the coordinates of the centre of the pattern on the screen, f and m are integers which are the radii of the fixed and moving gears, and r is the distance of the pen hole from the centre of the moving gear.

The program is based almost entirely on the Spectrum Basic interpreter's calculator (called by a RST 0028). This is controlled by a string of literals immediately following the call which describe what needs to be done, adding, multiplying and so on. Particular use has been made of the number fetching and storing facilities which are normally used for the calculator's memory area to manipulate numbers on the calculator stack (a plan of which is given in figure 1).

Functions

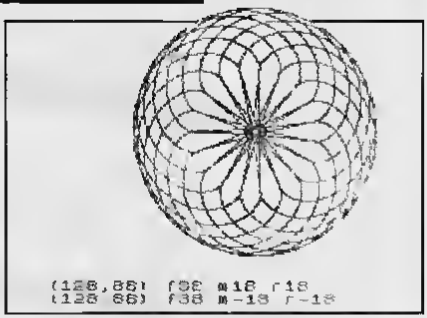
The functions of the different sections of program are:

FEFA — FF40 get the arguments from the REM statement which must immediately follow a USR call to this program and put them on the calculator stack after the six dummy values at the bottom to replace the calculator's memory area. If at any time an error is detected a jump is made to 1C8A which stops the BASIC program and produces an error report.

FF41 — FF54 calculates the hcf of f and m.

FF55 — FF74 calculates the size of angular increments $\Delta\theta$ and the total number of them in a complete pattern.

FF75 — FF8A sets the initial values of COSθ, SINθ, COSθ, SINθ, COS & SIN denote (f+m) cosθ& (f+m) sinθ and COSθ& SINθ denote r cosθ and r sinθ and calculates cos$\Delta\theta$, sin$\Delta\theta$, cos$\Delta\theta$ and sin$\Delta\theta$.



FF8B — FF9D increments θ (by changing COSθ and SINθ).

FF9E — FFAF increments θ (by changing COSθ and SINθ).

FFB0 — FFBB calculates the plot position (x,y).

FFBC — FFE2 checks to see whether (x,y) is on the screen. If so it is PLOTted by a USR call to 22DC.

FFE3 — FFF2 decrements the step count. If this is not zero and there is no keyboard break, then the loop is executed again.

FFF3 — FFFE resets the calculators memory area and clears the stack.

FFFF returns to BASIC.

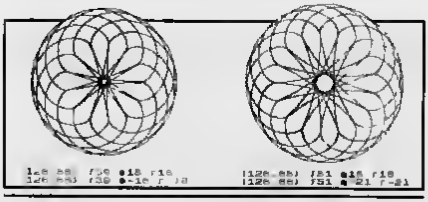
Stack Map

set mem	*get mem*	*contents*
C0	E0	calc0
C1	E1	calc1
C2	E2	calc2
C3	E3	calc3
C4	E4	calc4
C5	E5	calc5
C6	E6	a
C7	E7	b
C8	E8	f
C9	E9	m
CA	EA	r
CB	EB	t
CC	EC	$\Delta\theta$
CD	ED	COSθ
CE	EE	SIN θ
CF	EF	cos $\Delta\theta$
D0	F0	sin $\Delta\theta$
D1	F1	COSθ
D2	F2	SIN θ
D3	F3	cos $\Delta\theta$
D4	F4	sin $\Delta\theta$
D5	F5	x
D6	F6	y

```
  10 REM SPIROGRAM
  20 CLEAR 65273
  30 LET P=1+PEEK 23730+256*PEEK
23731
  40 GO SUB 1000
  50 INPUT "(";aj";";bj;") f";fj"
m";mj" r";jr
  60 RANDOMIZE USR P: REM a,b,f,
m,r
  70 GO TO 50
1000 REM poke SpiroGram
1010 LET d=p
1020 DEF FN d(d$)=(d$<="9")*(COD
E d$-CODE "0")+(d$>="A")*(10+COD
E d$-CODE "A")
1030 READ d$
1040 POKE d,FN d(d$(1))*16+FN d(
d$(2))
```

```
1050 LET d=d+1
1060 LET d$=d$(3 TO )
1070 IF d$<>"" THEN  GO TO 1040
1080 READ d$
1090 IF d$<>"" THEN  GO TO 1040
1100 RETURN
1200 DATA        "DFFE3A2039E7"
1210 DATA "FEEA2034E5FDC801"
1220 DATA "8E06051805DFFE2C"
1230 DATA "2026C5E7CDF824C1"
1240 DATA "FDC8176281A10ED"
1250 DATA "FDC8017E2015E122"
1260 DATA "5D5CFDC801FEEFA0"
1270 DATA "A0A0A0A0A03818D1"
1280 DATA "C38A1C2A635C2268"
1290 DATA "5CFFE82AE92AE8FC"
1300 DATA "033600020 1E83202"
1310 DATA "31370F902A331BF"
1320 DATA "310F1831E8E905A1"
1330 DATA "0FEA042AE8E9BF2A"
1340 DATA "0F042731E904E805"
1350 DATA "2A27C8020 3E8E90F"
1360 DATA "A0FC20FC1FEAA0F0"
1370 DATA "F905A10FFC043120"
1380 DATA "011F3AEFEEEF04ED"
1390 DATA "F0040FEDEF04EEF0"
1400 DATA "04033CD02CE02F2F3"
1410 DATA "04F1F4040FF1F304"
1420 DATA "F2F4040 3D1020202"
1430 DATA "E6ED0FFF10F27E7EE"
1440 DATA "0FF20F27F5360022"
1450 DATA "F636001EF5344000"
1460 DATA "00FF03370014F634"
1470 DATA "40B000AF033700 0A"
1480 DATA "34A0B000DC222D33"
1490 DATA "020202E8A103C837"
1500 DATA "00043010073 8CD54"
1510 DATA "1F3890219 25C2268"
1520 DATA "5C2A635C22655CC9"
1530 DATA ""
```

```
FFF4 DF        FNOC  RST 0018     fetch char being interp'd
FFF5 FE34            CP A 34      is it a "("
FFF7 2039            JR NZ,ERROR  if not jump to ERROR
FFF9 E7              RST 0020     fetch next char to be interp'd
FFFA CDF824          CP A,FA      is it a "FN"
FFFC 2034            JR NZ,ERROR  if not jump to ERROR
FFFE E5              PUSH HL      the address of the arguments
FFFF FDCB0188        RES 7,(IY+01) reset bit 7 of (FLAGS)
                                  to check syntax of arguments
FF03 0605      ARGS  LD B,05      number of arguments
FF05 1805            JR FIRST     jump to first, there is no
                                  separator before first argument
FF07 DF        NEXT  RST 0018     fetch char being interp'd
FF08 FE2C            CP A,2C      is it a ","
FF0A 2026            JR NZ,ERROR  if not jump to ERROR
FF0C C5        FIRST PUSH BC      the argument count
FF0D E7              RST 0020     fetch next char to be interp'd
FF0E CDF82A          CALL 2AF8    call the expression evaluator
FF11 C1              POP BC       the argument count
FF12 FDCB0176        RST 6,(IY+01) set (NE) if numeric expression
                                  reset (Z) if string expression
FF16 281A            JR Z,NERROR  jump to NERROR if string exp
FF18 10EF            DJNZ NEXT    decrement argument count,
                                  if zero to the jump to next
FF20 FDCB0176        RST 6,(IY+01) set (NZ) if interpreting
                                  reset (Z) if syntax checking
FF24 2015            JR NZ,NEGIN  jump to NEGIN if arguments have
                                  been stacked by expr. evaluator
FF26 E1              POP HL       address of arguments
FF27 225B5D          LD (NOSD),HL restore (CH-ADD) to first argument
FF2A FDCB01F6        RST 7,(IY+01) to interpret arguments
FF2E EF              RST 0028     call the calculator
FF2F A0              DEFB         put six dummy values at the
FF30 A0              DEFB         bottom of the calculator stack
FF31 A0              DEFB         for the calculator to use
FF32 A0              DEFB         instead of MEMBOT (enables the
FF33 A0              DEFB         set-mem C0,C1,  & get-mem M0,M1,
FF34 A0              DEFB         literals to be used)
FF35 38              DEFB end-calc
FF34 1801            JR ARGS      jump to ARGS, add arguments
                                  a,b,f,m,r to the stack in
                                  positions 6,7,8,9,A respectively
FF39 C39A10    NERRO JP 10BA      stop program and produce
                                  error report
FF3B 2A635C    NEGIN LD HL,(STKBOT) address of the bottom of
                                  the calculator stack
FF3E 22685C          LD (MEM),HL  address of the area used for
                                  calculators memory (usually MEMBOT)
FF41 EF              RST 0028     call the calculator
FF42 BF              DEFB get f
FF43 2A                   abs(f)  |f|
FF44 A9                   get m
FF45 2A                   abs(m)  |m|
FF46 B8                   get |f|
FF47 BC                   get |m|
FF48 03                   subtract  |f|-|m|
FF49 36                   less-0
FF4A 0002                 jump if |f|<|m| to GREATO
FF4C 01        GCLX0      exchange  so that larger number I is on
                                  top of smaller number m
FF4D B8        GREAT      get m
FF4E 32                   l-and-m  returns remainder and quotient
                                  on top of stack
FF4F C8                   delete   the quotient
FF50 31                   duplicate the remainder
FF51 37                   greater 0
FF52 00F9                 jump if remainder  0 to NCLIN
FF54 C2                   delete   the zero remainder
FF55 A3                   range-#
FF56 31                   duplicate
FF57 C0                   add      r
FF58 31                   duplicate
FF59 C0                   add      2r
FF5A 18                   negate   -2r
FF5B 31                   duplicate
FF5C B8                   get f
FF5D A9                   get m
FF5E 05                   divide   f/m
FF5F A1                   constant1
FF60 C0                   add      1+ f/m
FF61 BA                   get r
FF62 04                   multiply r(1+ f/m)
FF63 2A                   abs(r(1+ f/m))
FF64 B8                   get f
FF65 A9                   get m
FF66 0F                   add      f+m
FF67 2A                   abs(f+m)
FF68 0F                   add      |f+m| + |r(1+ f/m)|
FF69 04                   multiply -2m(|f+m| + |r(1+ f/m)|)
FF6A 27                   integer  INT( -2m(|f+m| + |r(1+ f/m)|))
```

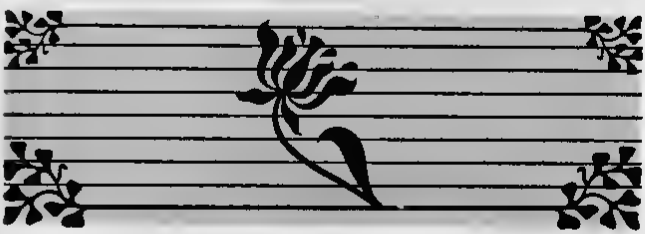



```
FF8E 31                 duplicate number of steps in one circuit
FF8F 39                 get n
FF90 06                 multiply
FF91 E0                 get half
FF92 05                 divide
FF93 2A                 absolute
FF94 E7                 integer   π/half INT(-2π(|fvm| + |r(1+ f/n)|))
FF95 C9                 set t     number of steps in complete pattern
FF96 C2                 delete
FF97 05                 divide    -2π/INT( -2π(|fvm| + |r(1+ f/n)|))
                                  largest angular increment which will
                                  not leave gaps in the pattern
FF98 E8                 get f
FF99 E9                 get m
FF9A 02                 add       fvm → COS θ → mem-09
FF9B 4D                 const-0   0   → SIN θ → mem-0E
FF9C E0                 get Δθ
FF9D 20                 cos       cos Δθ    → mem-0F
FF9E E0                 get Δθ
FF9F 17                 sin       sin Δθ    → mem-10
FFA0 E4                 get r     r   → COS θ → mem-11
FFA1 4D                 const-0   0   → SIN θ → mem-12
FFA2 E8                 get f
FFA3 39                 get n
FFA4 05                 divide    f/n
FFA5 A1                 const-1
FFA6 0F                 add       1+ f/n
FFA7 E0                 get Δθ
FFA8 04                 multiply  Δθ' = (1+ f/n)Δθ
FFA9 31                 duplicate
FFAA 20                 cos
FFAB 01                 exchange  cos Δθ'   → mem-13
FFAC 17                 sin       sin Δθ    → mem-14
FFAD 38         DEFB    end-calc
FFAE EF         LOOP    RST 0028  call the calculator
FFAF 8E         DEFB    get SIN θ
FFB0 EF                 get cos Δθ
FFB1 04                 multiply  SIN θ cos Δθ
FFB2 E0                 get COS θ
FFB3 F0                 get sin Δθ
FFB4 04                 multiply  COS θ sin Δθ
FFB5 0F                 add       SIN(θ+Δθ) = SIN θ cos Δθ + COS θ sin Δθ
FFB6 8E                 get SIN θ
FFB7 EF                 get cos Δθ
FFB8 04                 multiply  COS θ cos Δθ
FFB9 E0                 get SIN θ
FFBA F0                 get sin Δθ
FFBB 04                 multiply  SIN θ sin Δθ
FFBC 03                 subtract  COS(θ+Δθ) = COS θ cos Δθ - SIN θ sin Δθ
FFBD 8D                 set COS θ
FFBE 02                 delete
FFBF 8E                 set SIN θ
FFC0 02                 delete
FFC1 F2                 get SIN φ
FFC2 F3                 get cos Δφ
FFC3 04                 multiply  SIN φ cos Δφ
FFC4 E0                 get COS φ
FFC5 F4                 get sin Δφ
FFC6 04                 multiply  COS φ sin Δφ
FFC7 03                 subtract  SIN(φ+Δφ) = SIN φ cos Δφ + COS φ sin Δφ
FFC8 F1                 get COS φ
FFC9 F4                 get sin Δφ
FFCA 04                 multiply  SIN φ sin Δφ
FFCB 03                 subtract  COS(φ+Δφ) = COS φ cos Δφ - SIN φ sin Δφ
FFCC 01                 set COS φ
FFCD 02                 delete
FFCE D2                 set SIN φ
FFCF 02                 delete
FFD0 E6                 get a
FFD1 E0                 get COS θ
FFD2 0F                 add
FFD3 F1                 get COS φ
FFD4 0F                 add
FFD5 27                 integer   x = INT(a+ COS θ + COS φ)
                                  = INT(a+ (fvm) cos θ + r cos φ)
                                  mem-15

FFD6 E7                 get b
FFD7 E0                 get SIN θ
FFD8 0F                 add
FFD9 F2                 get SIN φ
FFDA 0F                 add
FFDB 27                 integer   y = INT(b+ SIN θ + SIN φ)
                                  = INT(b+ (fvm) sin θ + r sin φ)
                                  mem-16
FFDC F5                 get x
FFDD 34                 less-0
FFDE 00E2               jump to NPLOT if x<0
FFDF F6                 get y
FFE0 34                 less-0
FFE1 00EB               jump to NPLOT if y<0
FFE2 F5                 get x
FFE3 3440BC000FF        stk-data 255 decimal
FFE4 03                 subtract
FFE5 37                 greater-0
FFE6 0014               jump to NPLOT if x>255dec
FFE7 F6                 get y
FFE8 3440AC000AF        stk-data 175 decimal
FFE9 03                 subtract
FFEA 37                 greater-0
FFEB 000A               jump to NPLOT if y>175
FFEC 3A8C8000DC22       stk-data 22DC hexadecimal
                                  address of PLOT x,y routine
FFED 2B                 RST call to PLOT routine
FFEE 3302               jump to PLOTC
FFEF C2         NPLOT   delete y
FFF0 02         PLOTC   delete x or value returned by RST
                                  if PLOT routine was executed
FFF1 E8                 get t
FFF2 A1                 const-1
FFF3 03                 subtract
FFF4 C8                 set t
FFF5 37                 greater-0
FFF6 0004               jump to CONT if t>0
FFF7 38                 end-calc
FFF8 1807               JR END
FFF9 38         CONT    end-calc
FFFA C8541F             CALL 1F54   return C (carry flag set)
                                    unless 'break' i e caps shift
                                    and space keys being pressed
FFFD 3898               JR C,LOOP   continue if no break
FFFE 2A5B5C     END     LD HL,5C5B  HL=CURSOR the address of the
                                    calculators normal memory
FF00 226B5C             LD (MEM),HL
FF03 2A63C0             LD HL,(STKBOT) address of stack bottom
FF06 226550             LD (STYTOP),HL delete the stack by overwriting
                                    the address of the stack top
FF09 C9                 RET         return to BASIC
```

The UDG Bank

84 UDGs must be enough for anyone. B. J. Kamphuis shows us how to achieve this on a Spectrum.



User Defined Graphics are a valuable and relatively easy means of producing arcade action, background pictures or business graphic details. Although twenty one are easily obtainable, it is surprising how often you find you could do with a few more.

There are many ways of getting an increased number of UDGs and B. J. has adopted the method of storing four banks which are transferred to and from the set UDG area of memory as required. Now if 168 bytes have to be moved by BASIC a noticable delay is introduced so a short machine code routine is used to keep the program moving smoothly. The UDGs are stored in four banks named not surprisingly bank1, bank2, bank3 and bank4. Every bank can be transferred to the active or normal UDG set and back.

To define a bank all you need to do is set them up as ordinary UDGs from BASIC as normal, then use this program to store the characters in the memory reserved for that bank. To move a bank of UDGs to the storage area all you have to do is use the command, either from a BASIC program or as a direct command: **RANDOMIZE USR address: REM W1**.

Now 'address' is either 64000 or 31232 depending on whether you have a 16K or 48K Spectrum, and the 'W' after the REM tells the machine code routine to write from the normal UDG area to store, and the '1' tells it which bank to use. Therefore when setting up your UDG banks you will use W1, W2, W3 and W4 depending on which bank you are working on.

The opposite effect, that of loading the normal UDG area with the characters in a bank is achieved by using **RANDOMIZE USR address: REM L1** – note 'L' instead of 'W'. Once the banks have been set up then save the whole four sets plus the machine code with the command SAVE "udgs" CODE address, 1535 and to use in a program include after the program has loaded the commands CLEAR address: 1: LOAD "" CODE.

```
  1 REM
  2 REM 16K version
  3 REM
 10 CLEAR 31231: DATA 42,93,92,
35,35,126,254,87,202,30,122,254,
76,202,60,122,201,35,126,214,48,
33,88,127,17,0,122,130,87,1,168,
0,237,176,201,35,126,214,48,17,8
8,127,33,0,122,132,103,1,168,0,2
37,176,201
 20 FOR f=31232 TO 31248: READ
a: POKE f,a: NEXT f
 30 FOR f=31262 TO 31279: READ
a: POKE f,a: NEXT f
 40 FOR f=31292 TO 31309: READ
a: POKE f,a: NEXT f
```

```
  1 REM
  2 REM 48K version
  3 REM
 10 CLEAR 63999: DATA 42,93,92,
35,35,126,254,87,202,30,250,254,
76,202,60,250,201,35,126,214,48,
33,88,255,17,0,250,130,87,1,168,
0,237,176,201,35,126,214,48,17,8
8,255,33,0,250,132,103,1,168,0,2
37,176,201
 20 FOR f=64000 TO 64016: READ
a: POKE f,a: NEXT f
 30 FOR f=64030 TO 64047: READ
a: POKE f,a: NEXT f
 40 FOR f=64060 TO 64077: READ
a: POKE f,a: NEXT f
```

Graphics '85

A comprehensive review of the state of the art by Colin Christmas.

As we see this old year out and welcome the new one in it s a better time than most to stand back and take stock Looking back (and leaving the prophecies and predictions to others) it must surely be agreed that for Spectrum users with an eye on Graphics It has been a most exciting year I can t speak for other departments but for me it has been Christmas every issue

In this issue I want to do something special — take a look at the goodies that have come our way Our way? Who are We? We are the Graphics Grabbers Artwork Addicts Design Doodlers For us the screen is a window on a world of colour images line shape pattern design texture light and shade And like a window it opens out into an exciting new visual world For business for profit for learning for discovering or for pleasure From the weekend dabbler or doodler to the serious professional from the games enthusiast to the educational user from beginner to experienced programmer and right across the age range you will find Spectrum owners who are hooked on graphics

It s fairly formidable task — covering the range of Graphics Hardware and Software now available to Spectrum owners but let s get started

Software

PRINT N PLOTTER Products have given us two thoroughbreds in graphics packages stablemates in fact Both are already household names in the world of Spectrum Graphics *Paintbox* redesigned and renamed *Paintplus* since first reviewed and *Screen Machine*

Paintplus now has over twenty new features added to the original It is Microdrive and Grafpad compatible and offers cursor control from either keyboard or joystick swift and smooth or slow and smooth You have a choice here too Power to program up to eighty four user definable characters in the UDG Editor experimenting all the time with the Sketch Pad facility before deciding to use them in screen graphics or programs Also on the Menu Precision Plotter enabling high resolution screen graphics work to be attempted and then combined with your already designed UDGs and stored in four UDG banks

Multiple screen files can be achieved by working your way through the twenty eight page manual which accompanies the software cassette The new features are found here in Precision Plotter *Screen Planner* and *Organiser* They include a mode called Paperwash a facility for Grabbing from Screens Box Draw Enlarge Edit modes and many more One side of the cassette has demonstration programs to inspire the faint hearted

This toolkit needs patient and diligent effort put in to it before those efforts are really rewarded It is not for those who want an instant meal to be taken on the move so to speak It s not for doodlers either Members of either group will enjoy the heart of the product only To get the most out of it you need some application skills

If *Paintplus* were an O Level, then *Screen Machine* would be an A Level By that I mean that success with the one will probably lead to moving up to the other It is capable of lifting earlier work done easy on Paintplus to new and more professional heights

The demo programs on the cassette are not only inspiring as was the case with *Paintplus* but in the case of *Screen Machine* are also meant to be instructive The program for the example of Flip Screen Animation can like the others be broken into so that you can see or begin to see how this impressive feat was achieved The manual explains too how it was done and with this and its other detailed explanations instructions and suggestions gives a clear indication right from the start of how powerful a utility *Screen Machine* really is

It should be said that a good working knowledge of BASIC and of the Spectrum Manual itself is essential before trying to get to grips with this tool One of its most innovative and useful facilities is that of enabling programmers to save time and memory space by having access to instant Machine Code routines for Compressing Screen displays saved normally as 6912 Bytes but now being stored as only 2475 bytes There are sections too in the manual with instructions for adapting *Screen Machine* to microdrive for a wide range of screen modifications and for text compilation into machine code

These two from Print N Plotter then a invaluable twosome, especially when teamed up together They will not suit every style or requirement, so read on

From NEW GENERATION SOFTWARE came *Lightmagic* And that might just suit some It is easier to use or rather to get straight into and in the true sense of the word it is fun If all you want to do to start off with is to make pictures play with UDGs and so on in a light hearted way that will be entertaining and will not tax your concentration too greatly at first then *Lightmagic* is the friendly tool for the job It is therefore a good starter pack in my opinion and I have observed its magnetic attraction in action with children aged eight to sixteen with only keyboard familiarity on the Spectrum

The manual gets full marks from me Clear easy to read well planned and with information instructions index tips

and summaries all included in such a way as to show that a great deal of thought went in to its organisation and production. Text Mode and UDG Mode are fascinating and easy to work with. Text and characters appear at the bottom of the screen and can then be picked up and positioned anywhere you want them in your picture or design.

Then just when you will probably be ready to move on to more ambitious projects graphically, Lightmagic proves its magic again. The program also offers a facility called UDG Designer for the creation and editing of your own graphics characters which you can then use in your own pictures and programs. The facility for compressing pictures and saving memory is offered in the COMP SCREEN option. This is loaded separately from the cassette. It's there in other words when you need it. Later rather than sooner probably.

Alongside Lightmagic not for comparison but because for me they have the same feel about them, might come *Leonard*, from CREATIVE SPARKS. Again full marks for the manual. Manuals ought to be user friendly as the software I think and in the case of *Leonardo* both are in fact true. I don't hesitate to recommend it as an excellent starter pack which is then capable of extending your own abilities as you learn to use it. A preliminary review of *Leonardo* appeared in the last issue of ZXC.

This is a good place to suggest that anyone who is into graphics or who wants to get started should get out and about into the shops to make their own evaluations. Failing that use the information in this article to put pen to paper and write off and ask for details of packages from the manufacturers.

Lightpens

I've had most success to date with the package from Oktronics. The pen itself is rather like a biro or felt tip pen. It is attached by a wire to a control interface which of course comes with the package. The interface is plugged into the back of the Spectrum. A program on cassette is included.

The glass screen of your monitor is the working area and drawing surface so some consideration has to be given as to whether this is the way you want to work. Then there are practical aspects such as the distance of your screen from your keyboard and the fact that you have to work on a perpendicular face. The height of the screen is therefore important if you do not want to suffer from muscle fatigue in your drawing arm.

Lightpens give you a physical contact and interaction with your drawing surface if that is important. Calibrating the pen each time may prove a chore but after that it's plain sailing within the limitations of the power of the program. Again it's a good way of getting started on the very basics of graphics of getting into the picture as it were. Sensibly introduced in the classroom it could be useful aid and introduction for children in an educational context. It is limited though in its potential for advanced or complex screen designs. Graphics Tablets give you similar physical point of contact with your drawing surface. This time it is horizontal and again a pen is used. There's a review of the *Saga* Graphics Pad in this issue. So when you are ready look it up. They certainly take you further than the lightpen. But then you pay a lot more for the facilities they offer.

Now for something almost completely different: the *Sinclair LOGO* pack. Another excellent starter but as I have hinted quite different.

This pack has very obvious educational applications and for very young children. The founding father of the LOGO language intended it as a language for children which would develop logical thinking introduce young minds to computer programming and have very definite terms of reference for the teaching and development of mathematical concepts. Drawing is achieved by moving a small graphics 'turtle' — a triangle — around the screen. This is done by sending through the computer commands known as Primitive Procedures (mostly single words and abbreviations of those words). Your sense of direction needs to be accurate and formulated mathematically. Once you have established procedures for drawing say a square this group of procedures can be assigned a single word or name which LOGO will then understand as a command to repeat the whole set of procedures.

The emphasis or bias is fundamentally mathematical — arithmetical or geometric. You do not first learn to draw a square you also learn what makes a square what it is and from there the difference between a square and a rectangle or a parallelogram.

It is a language itself apart from BASIC. Hence learning to use it is learning to program a computer in another language. The graphic aspect being displayed on the screen is part of the incentive and motivation for progressing with the new language.

Two fairly weighty and comprehensive books or manuals are part of the pack. The first book deals exclusively with Turtle Graphics and is an absorbing and refreshingly different kind of programming experience. The second book acts as a reference manual for *Sinclair LOGO*. The growth use and development of LOGO by Spectrum owners especially in schools will I think be affected by the cost factor.

When OREAM SOFTWARE released *Computer Aided Designer* my own children had not had their Spectrum for long. They like me were exploring the full graphics potential of the machine when *C A D* turned up and kept us enthralled for days. Now still an old favourite I would recommend it as another in the Starter category. With very obvious educational values and as a springboard for more ambitious projects later in Design.

The manual is simple and very straightforward — alphabetically leading you through the twenty seven commands available in the program. Some forty custom shaped graphics UDGs can be designed. By giving precise measurements most geometric shapes can be drawn filled and so on. It remains impressive after all this time and the potential for drawing in 3D is considerable.

Similarly another old favourite *VU 3D* from PSION. This has the added and appeal of enabling the viewer to move around the object in 3D. Graphics and Design pure and simple. High resolution colour and an incredible understanding of perspectives are real bonuses with this program.

Future designers in the Aircraft or for that matter almost any other industry may have started young with something like *C A D* or *VU 3D*.

I doubt if they would have been able to afford the *RD Digital Tracer* from RD Laboratories. This is closer to an instrument than anything else I've come across in graphics and design hardware and software for the Spectrum.

It comes in two versions the Standard and the Professional. Both are fairly highly technical and sophisticated tools. The Tracer consists of a short fixed arm and pivot from which extends a drawing arm hinged at the centre with another floating pivot which moves across your drawing surface area.

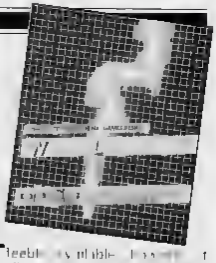
The arm is connected to the computer by a length of cable via an interface plugged into the rear port of the Spectrum. A cardboard template and transparent grid overlay are included for calibration purposes. The tracer is a precision instrument. The software cassette contains five programs. The usual options are offered in the first: plotting single points construction of basic geometric figures filling hatching change of ink border paper colour adding text UDGs and so on.

The display image can be moved up down and from side to side scaled up and down and reversed. Multiple screen images including images at different scales and at different positions can be achieved. By adding other BASIC routines and software the Tracer's capabilities can be extended into the field of statistical analysis. This immediately puts the Tracer into a specialist Graphics and Display category. Although the Tracer can be used with the ZX81 and 16K Spectrum its full potential can only really be developed on the 48K and then only by competent programmers. It's a versatile instrument for the specialist.

It's the season of Good will and all that so why not give a last mention for all whose speciality is Games Designing. It's been around for a while but standing the test of time in lots of ways. I'm referring of course to the High level User Friendly Real time Games Designer from Melbourne House. Or as it is more commonly known *HURG*.

Still a powerful program and a very good manual. How did they do it in those all time greats like Pacman Donkey Kong and Space Invaders? HURG will tell you how.

It's a pretty good list of graphics goodies and that other seasonal express on comes to mind. There's something here for everyone. You have no excuse for not knowing how and from whom in Spectrum Graphics. Just how to enjoy the graphics power behind those buttons.



Zapping Your Graphics

ZX looks at some utilities that can help put some life into your graphics displays.

White Lightning

This program has been around for some time now and I well remember the hours of studying the little small typed 131 page manual trying to get to grips with it. It is not that the manuals badly written just the opposite it's just that you have to throw away all your knowledge of programming in BASIC and learn what amounts to two complementary new languages.

Spectra Forth is a variant of the Forth language and its implementation is explained in detail but there's no attempt to teach you how to program in Forth. This means that before you can get full benefit of this program you have to buy a book read it and become competent in Forth.

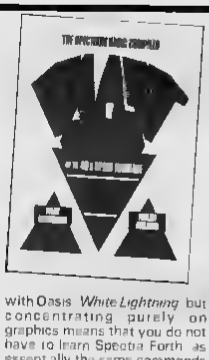
White Lightning not only gives you the use of a faster language but also over a hundred special commands in Ideal a specially designed language created by Oasis.

The presentation case holds the previously mentioned manual plus two tapes containing White Lightning a Sprite Development package and two demonstration programs. Look at the demos first they will convince you that it may be well worth taking the time to learn to use the program.

White Lightning is a superb package for the dedicated games writer it's good to see Forth having a practical use and the end results could be superior to any other games designer programs.

Spectrum Laser Basic

Marketed by Ocean but written by Oasis this is a very comprehensive package intended to enhance the ease and particularly the speed with which complex animated graphics can be produced. Over 100 extra commands and functions are provided to this end and all operate from within BASIC. The program has a lot in common



with Oasis *White Lightning* but concentrating purely on graphics means that you do not have to learn Spectra Forth as essentially the same commands are used as with their Ideal language.

There are a few changes mostly names of commands to aid clarity but basically this appears to be a stripped down but still very powerful version of *White Lightning*.

If you already have *White Lightning* then you will not get a great deal from this program but if you do not have WL and want a slightly simpler program which is essentially for graphics work then LASER BASIC is ideal. But be prepared to spend time learning to use it.

Ocean IQ. £14.95

Picture Logic

This is an attempt to introduce LOGO to children and adults. As well as the program tape it contains two booklets one aimed at adults and the other aimed at children — probably aged from around 12. As an introduction I feel it succeeds perfectly on both the levels attempted the children's book has step by step instructions and exercises followed by challenges. It is well set out with screen pics and diagrams. The adults book is written in less detail but is easily understood. Picture Logic supports 25 commands variables and four arithmetical functions (addition subtraction multiplication and division).

This is a gentle and pleasantly presented introduction to LOGO though I feel it is a little limited and you could soon reach the full extent of its capabilities. It would serve as an excellent introduction for schools though it is a bit expensive.

Addison Wesley Publishers Ltd £22.75

Blast

Although this is not technically or specifically a graphics program I feel that much of its use will be for speeding up games and so decided to include it here. *BLAST* has been advertised for some time now and several versions exist.

The advertising seems to be a little optimistic. I was moved to comment in the last issue in the All Sinclair Machines claim and of course it does not work on the QL or ZX81 but on all 48K versions of the Spectrum. It was an ambitious project and very nearly succeeds in their claim to compile any BASIC program the program to do this takes up all but 2K of the Spectrum's memory. So now you have another problem who wants to compile programs of only 2K or less? The answer that OCS came up with was to provide an extra TOOLKIT program. As a toolkit it is probably the most flexible available. It allows you to save the program that you want to compile in a special format onto tape or microdrive.

So you load Toolkit load your program save your program in the special form on tape then move on to phase two. This consists of loading BLAST and starting the compiler. This is very easy if time consuming the program prompts for starting the tape and stopping compiles each block and when it is ready tells you to change tapes and save what it has done so far. This sounds complicated but is easy in practice. It is much easier on a twin microdrive system and OCS strongly urge you to get one.

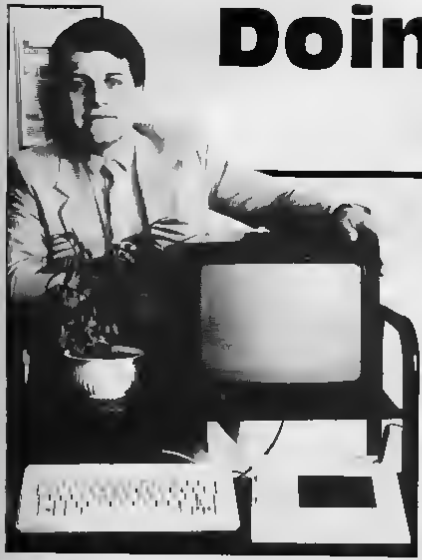
There are two forms of compiled code p code which is a sort of half way between machine code and BASIC and has the advantage of using less memory than either m c or the original BASIC but though faster than BASIC is slower than m/c. The second is real machine code this is usually larger than its Basic original (unusual) but faster than p code.

A useful feature is AUTO RUN which makes compiled programs hard to break and copy. Not so good is the fact that the planned extensions to BASIC had to be abandoned due to lack of room to make up for it a few more mediocre additions were made to the toolkit program.

Despite some reservations BLAST is by far the best compiler we have seen (so far) it worked perfectly with all the programs we tried. I'm not too sure I like the over optimistic advertising claims and one or two of our readers have written to tell us of problems they have had. These do seem to be with specialist applications and if you are not intending to use it for general programs but for some with vast amounts of data for example then it is best to phone or write to get confirmation that will do exactly what you require.

Oxford Computer Systems (Software) Ltd £24.95

Doing It With Style



There are quite a few graphics utilities on the market at the moment, but one that particularly caught our attention (mainly because it came in the biggest box) was *Style* from Saga Systems.

Style costs £29.95 and though that might seem a bit steep, you do get a Kempston compatible joystick included in the price. The interface is required because the onscreen cursor that you draw with is controlled by either a joystick or Saga's own Graphics Pad which

can be bought separately for an additional £79.95. That might seem expensive, but it is still the cheapest pad around.

The pad is a ceramic tablet rather like the old Etch-a-Sketch toys. You can draw onto this pad using the pressure pen that is built into it, and your hand movements are translated directly onto the screen. This is much easier to use for freehand drawing than the clusters of keys that most graphics utilities use, though you do lose some of the pixel fine precision of keyboard control as your hands are unlikely to be absolutely steady. However, *Style* does have a Zoom facility that allows you to magnify sections of the screen and tidy up any stray pixels caused by handshake.

To be perfectly honest, *Style* isn't the most versatile graphics utility that we've seen. The

functions that it offers are all fairly standard. Box, Circle, Fill and a few others. These are all quite well executed, especially the Box and Triangle options which allow you to move shapes around the screen and to try out different sizes of shapes before you drop them into place.

Where *Style* really scores, in conjunction with the Graphics Pad, is in ease of use. There are no massive manuals to plod through, and the icon driven menu is very simple to use. I find that most graphics packages require you to master some fairly finger tangling combinations of keys to move from drawing mode to another. With *Style* all you have to do is press one button to return to the main menu, then position the cursor over the relevant icon (a small circle for Circle, a squiggle for Freehand, etc.) and the program automatically returns you to your picture and is ready to carry out the next command.

The instruction leaflet says that you can read it while Style is loading, and will probably not need to use it again. And surprisingly, that proved to be the case. After just a few minutes trying out the icon menu I was happily doodling away on the Graphics Pad, drawing squiggly lines and boxes all over the place (it doesn't take much to keep me happy).

Actually, the ability to draw squiggly lines using the Pad is one area where *Style* does score over its competitors. I've always found trying to draw smooth curves on the screen just using the clusters of keys that most utilities use for cursor control, very difficult. Keyboard control does allow you more

precision, but slows you down a lot. The Graphics Pad loses some of that precision (though as I've mentioned the Zoom facility does allow you to tidy things up) but allows you to draw much more freely, as if you were drawing onto a sketch pad. For artistic failures like myself, who find keyboard control too fiddly, this is a big plus (though at a total cost of almost £110 it's not cheap).

I do have one criticism of *Style* though. The instructions admit that the freehand drawing option is virtually useless when using a joystick. Now I've always considered freehand drawing to be one of the most important facilities offered by graphics utilities (there are, after all, slow but adequate commands for circles and lines in BASIC), and the inability to use this facility without the additional cost of the Graphics Pad strikes me as a rather significant flaw, especially as the other options available are relatively limited when compared to other cheaper utilities.

To make the most of *Style* you really need to use it in conjunction with the Graphics Pad, and I must admit that I found using the two together very enjoyable. Admittedly the combined cost of Pad and software together seems high, but you simply won't get any kind of graphics tablet for a lower price. I've noticed that the advertising for *Style* mentions that it is used by software houses and educational establishments, and these are probably the sort of customers that *Style* is primarily aimed at (because they can afford it), and I think that schools in particular would find it genuinely useful. For the home user

though, I can only say that I enjoyed using *Style* and that it is at least worth trying out if you are sufficiently interested in graphics to consider the investment.

For further details, Saga can be contacted at 2 Eve Road, Woking, Surrey (04862 22977).

Light Screen Designer

Part Nine: by Toni Baker

```
ADDRESS   STATEMENT POINTED TO          FUN[illegible]                    ROM [illegible]
8C51      DF E4   DEFW [illegible],TXT1 [illegible]                       SYM [illegible]
8C54      E0 E4   DEFW [illegible]      Half [illegible]                  SYM SHF/R
8C57      E8 E4   DEFW [illegible],TXT2 Full Stop Toggle                  SYM SHF/R
8C6A      F0 E4   DEFW [illegible],TXT_EXIT  Cancel Text Mode             AF SHF/SPACE
8C8D      08 E4   DEFW [illegible],7 BIT     7 bit Wide Toggle            THIN VIDEO
8C8B      08 E4   DEFW [illegible]           Bold Type Toggle             INVERSE VIDEO
8C90      3A F5   DEFW [illegible],CAPS_LOCK Caps Lock Toggle             CAPS LOCK
8C92      52 00   DEFW [illegible],RET       Not Used                     ENTER
8C94      53 E4   DEFW [illegible],TC_LEFT   Cursor Left                  CURSOR LEFT
8C95      45 E4   DEFW [illegible],TC_RIGHT  Cursor Right                 CURSOR RIGHT
8C95      5F E4   DEFW [illegible],TC_DOWN   Cursor Down                  CURSOR DOWN
8C97      77 E4   DEFW [illegible],TC_UP     Cursor Up                    CURSOR UP
8C99      5C 00   DEFW [illegible],RET       Not Used                     DELETE
8C9B      F7 E4   DEFW [illegible],TEXT_EXIT Cancel Text Mode             SHIFT
8C9D      01 E5   DEFW [illegible],ALT_MODE  Alter Char Size              BOTH SHIFTS
8C9F      43 E3   DEFW [illegible],GRAPHICS  Graphic mode Toggle          GRAPHICS

8C81      01 00   DEFW [illegible]           HEIGHT of characters
8C83      01 08   DEFW [illegible]           WIDTH of characters

8C85      FF 01 01 01
          00 FE 0 FF                         PIXEL LAYOUT of text-cursor
```

OK. Hands up all those people who spotted that if you used the ARC_RAD routine in the last issue then HIDE and CURSOR_TYPE subsequently didn't work! You didn't notice? Well it's lucky I'm observant then. This bug was caused by a particularly daft oversight on my part whereby the ARC_RAD routine corrupted the IX register — (actually it's corrupted by the ROM but that's neither here nor there). Since the majority of the Light Screen Designer program relies upon IX having a constant value of DB40 then I'm sure you will appreciate the problems that such corruption may cause.

The solution is to re-assign IX within the main loop. If this is done then it will not matter whether the daughter routines corrupt IX since the mother routine will always restore it. To correct the bug it is therefore necessary to type in the following BASIC program along with Light Screen Designer. RUN the BASIC and re-SAVE the machine code. The correct on program is as follows:

```
10 FOR X=0 TO 61
20 POKE 56793+X, PEEK
(56797+X)
30 NEXT X
40 POKE 56855, 221
50 POKE 56856, 33
60 POKE 56857, 64
70 POKE 56858, 219
80 POKE 56915, 23
```

Right — that's over and done with. Now onto this episode. This is a particularly intricate piece of machine code engineering. This is the TEXT option available on the P key — easy to remember because PRINT is on the same key, and if you've got an old style Spectrum. Minus with rubber keys then quotes (") are on the same key. Once you hit text mode the familiar crosswire cursors disappear and are replaced by a small rectangle — this is the TEXT MODE CURSOR which you can manipulate around the screen with the cursor keys (with CAPS SHIFT if you have an ordinary Spectrum). But Text Mode allows you to do a whole lot more than just move a different shaped cursor around the screen. Allow me to elucidate:

First of all you could press a number or a letter. If you do this the [illegible] number or letter will appear [illegible] where the cursor was, and the cursor itself will move one square to the right. With letters of course, you can also use CAPS SHIFT to get a capital letter (Note CAPS LOCK works as expected). You can also use SYMBOL SHIFT to get a symbol — but this works slightly differently to normal.

If the normal use of SYMBOL SHIFT would be to produce a symbol then this works exactly as it should. If however it would normally produce a token keyword (for instance SYMBOL SHIFT Y which would normally produce the keyword AND) then you get something different. In general you get the E Mode symbol on the same key (for instance SYMBOL SHIFT Y would give square left bracket).

This means that you never have to enter E Mode but there are some exceptions. The COPYRIGHT symbol for example. SYMBOL SHIFT P will produce quotes, so I have taken the liberty of moving COPYRIGHT onto a different key. SYMBOL SHIFT I will now generate the required COPYRIGHT symbol. This leaves just three keys — Q, W and E — which don't have a symbol on them, and these are used as control keys, which will be explained in a moment.

As well as covering letters, numbers and symbols you can also use the graphics characters. Just press the GRAPHICS button to enter graphic mode as you would normally, and the same button

```
                                DND N3D0
T_CHR_B   T_CHR                 BIT 6,(IY+0)
                                JR Z,T_CHR                  Wait until a key is pressed
                                RES 5,(IY+0)                Signal "Ready for a new key"
                                LD B (IX+0)                 Die character code of key pressed.
                                CALL (PS4,NEAR_KEY          Test for CAPS SHIFT/SPACE
                                JR Z,T_CHR_1                Jump unless CAPS SHIFT/SPACE pressed
                                LD B,0                      D3 signals CAPS SHIFT/SPACE
                                CP A4                       Is character code
                                RET C                       Return if A contains a valid code
                                LD HL,SYMBOL_SY_TBL         Point HL to ROM table of "Symbol
                                                            "Shift Character Codes"

                                PUSH                        Locate character in table
                                LD DE,FFD0
                                ADD HL,DE                   Reposition HL so that it now points
                                                            into "Extended Mode with Shift" table
                                LD A (HL)                   Is E-Mode symbol on same key
                                CP "B"
                                JR NZ,T_CHR_2               Jump unless SYM SHIFT/I pressed
                                LD A,"©"                    COPYRIGHT symbol now on SYM SHF/I
T_CHR_2   T_CHR_3               AND A
                                RET P                       Return with codes 00, 01 or 02 for
                                SUB 05                      SYM SHF/B, SYM SHF/M and SYM SHF/N
                                RET                         respectively
                                JMP N33A
CAPS_LOCK                       LD A,(FLAGS2)
                                XOR 08
                                LD (FLAGS2) A               Complement CAPS LOCK flag
                                RET
                                JMP N345
GRAPHICS                        LD A,(MODE)
                                XOR 08
                                LD (MODE),A                 Complement GRAPHICS flag
                                RET
```

```
                GRG E5AC
C5      T_LOCATE PUSH BC
FE07            CP 07
3004            JR NC,T_LOC_
                                        Jump if A contains either a graphic
                                        symbol or a TOG
EDB4B65C        LD BC,(CHARM)           Point BC to Pixel-layout table in
                                        RAM (see PROG)
1806            JR T_LOC_P
DEF0    T_LOC_1 SUB 90
38C0            JR C T_LOC_3            Jump if A contains a graphic code
ED4B7B5C        LD BC,(UDG)             Point BC to Pixel-layouts for User
                                        Defined Graphics (Byte Range of
                                        A is now 00 to 15h)
67      T_LOC_2 LD H,A
6F00            LD L,00                 HL= character code
29              ADD HL,HL
29              ADD HL,HL
29              ADD HL,HL
09              ADD HL,BC               HL: points to pixel layout of
                                        required character
C1              POP BC
C9              RET
4       T_LOC_3 LD B,A                  Low nibble of B indicates which
                                        graphic symbol is required
CD5008          CALL DEF;FO_IN_1        Construct graphic symbol in MEMORY
219258          LD HL,MEMORY            Point HL to this newly created
                                        pixel layout
C1              POP BC
C9              RET
```

again to get back to normal. In this manner, the keys 1 to 8 will produce block graphics, which may be inversed by the additional use of SHIFT. The letter keys will produce the User Defined Graphics. In this program, five extra UDG's are allowed — on keys V, W, Y and Z. To use them it is necessary to allow an extra forty bytes in the UDG are of RAM and graphics V, W, X, Y and Z may be defined in this area.

To break with tradition SPACE will print a space — it will not escape from Text Mode. There are two ways to exit Text Mode. One is to press SPACE with CAPS SHIFT and the other is to press ENTER.

Characters

It's worth pointing out at this stage that the characters are not necessarily printed on whole character squares. Depending upon the position of the cursor a character may overlap two or more character squares. You see when you hit TEXT MODE and you change from crosswire cursor to text cursor, the text cursor is printed as an outline whose top left hand corner exactly coincides with the position of the crosswire cursor — to the exact pixel!

You can print text with this facility in many different ways. We've already seen the effect of CAPS LOCK and GRAPHICS but what about the rest of the control keys?

TRUE VIDEO will switch between 7 pixel wide and 8 pixel wide characters. 7 pixel wide characters are obtained by over printing the 8th column of pixels which leaves less space between two consecutive characters. This will give you thirty six characters across the screen instead of thirty two. I personally think that this makes text look much better.

INVERSE VIDEO will switch between standard and bold typeface. Bold type is produced by printing each INKEd pixel twice instead of once. Bold type looks very nice and of course there's nothing to stop you using 7 pixel wide bold characters if you want to.

You can also print characters in *italics*. SYMBOL SHIFT W will switch to half slope italics (sloping two pixels down for every one pixel across). SYMBOL SHIFT E will switch to full slope italics (sloping at forty five degrees) and SYMBOL SHIFT Q will switch to fully upright characters (italics off).

Finally you can change the *size* of characters. You are not restricted to printing characters the size of a standard character square — you can have double width, double height, triple height and so on. To achieve this press both shifts together (or the Extended Mode key on the Spectrum Plus). You can then alter the size of the cursor by pressing the cursor keys: RIGHT to increase the width and LEFT to decrease the width, DOWN to increase the height and UP to decrease the height. Space will allow you to ESCAPE from Extended Mode and return the cursor keys to their normal functions. Any other key will be acted upon as normal, as well as escaping from E Mode.

```
                GRG E371
F5      PR_N2_RE PUSH AF                Stack the zero flag
3E20            LD A,"space"
CF              RST 10                  Print a space
F1              POP AF                  Restore the zero flag
2007            JR NZ,PR_N2_1
3E20            LD A,"space"
CF              RST 10                  Print a second space
3E20            LD A,"space"
CF              RST 10                  Print a third space
C9              RET
7A      PR_NO_3 LD A,D
CF              RST 10                  Print CHR$(D);
78              LD A,B
CF              RST 10                  Print CHR$(B);
C9              RET

                GRG E384
C5      T_DOLOUR PUSH BC
D5              PUSH DE
E5              PUSH HL                 Stack registers
CD0A09          CALL GRG;FO_ATTR        Deliver appropriate attribute byte
E1              POP HL
D1              POP DE
C1              POP BC                  Restore registers
23              INC HL                  HL: points to next byte in screen
1A00            LD A,78                 A:= number of pixels in this byte.
C9              RET
```

```
                GRG E391
3E08    TX_PRINT LD A,08
CF              RST 10
DF      TXLOOP_1 RST 18                 A':= Number of rows in pixel layout
3A0183          LD A (DEL0B2)
F5F530          LD (N_REC),A            (N_REC):= Number of times each row
                                        must be duplicated.
3A4F5B  TXLOOP_2 LD A,(J_FLAGS)
EE10            XOR 10
32EB06          LD (J_FLAGS),A          Complement OVR/OVER NOW flag
C5              PUSH BC                 Stack cursor coordinates
D5              PUSH DE                 Stack pixel layout pointer
E5              PUSH HL                 Stack address of screen-byte
                                        containing cursor
79              LD A,C                  A:= column number of cursor (in pixels)
E607            AND 07
AF              LD C,A                  C:= position within screen-byte
                                        of cursor
1A              LD A,(DE)
57              LD D,A                  D:= current row from pixel layout
DECB0B5B        SLA D,(J_FLAGS)
7B00            JR Z,TXP_1              Jump unless using BOLD typeface
F                       A,A             Shift left one bit. Bit 0 reset
BE              OR D                    Use each bit twice if not
57              LD D,A                  D: now amended for BOLD type
3A0583  TXP_1   LD A,(WIDTH)
47              LD B,A                  B:= number of times each pixel
                                        must be duplicated
3E08            LD A,08                 A:= number of pixels in screen-byte
5F              LD E,A                  E:= number of bits in pixel layout row
0C              INC C
1B03            JR TXALLROW
30              DEC A                   A  number of remaining pixels in (HL)
CB06            RLC (HL)                Move next pixel from screen into bit 7
CB              RLC C
20FA            JR NZ,TXALLROW1         Pixel at cursor position now
                                        in bit 7 of (HL).
C5      TXLOOP_3 PUSH BC                Stack character width (B)
F5              PUSH AF                 Stack screen-byte pixel counter
CB00            RLC B                   Move next pixel from pixel-layout
                                        into bit 0 of B
```

Overall then it would seem that the text facilities of LSD are pretty powerful. You can put text wherever you want it — to the exact pixel — you can print it any size you want and in a large variety of typefaces (twelve in total). You can escape from text mode by pressing CAPS SHIFT/SPACE or ENTER. You can re enter text mode by pressing key P or return to BASIC by pressing SPACE.

The Light Screen Designer series is now very nearly complete. The next issue will contain the penultimate episode which will be all about drawing ellipses. The final part — part eleven — will deal the colouring in. I know a lot of people have been waiting for that facility. After part eleven there will be an Epilogue (I prefer to call it an Epilogue rather than a Part Twelve because the *program* will be completed in Part Eleven). This will be just to round everything off nicely. I'll leave you now to feed in all this machine code. Bye bye till next time.

Tom Baker

```
9D4C57   YELOOP_A   LD A,(P_FLAG)          Bit 0 of Ca= INVER status
7E                  LD A,(HL)
B7                  RLCA                   Bit 0 of A= current pixel from screen
A1                  AND C                  Bit 0 of A= 0 if INVER 0; or current
                                           pixel from screen if INVER 1
CB19                RR B
CB19                RR C                   Bit 0 of C= INVERSE status
A9                  XOR C                  If INVERSE 1; then complement
                                           bit 0 of A.
AA                  XOR D                  Bit 0 of A= current pixel from
                                           required pixel-layout, with OVER and
                                           INVERSE currently implemented.
1F                  RRA                    Carry= pixel to print
CB16                RL (HL)                Bit 0 of (HL): correctly stores pixel
F1                  POP AF                 A = number of remaining pixels in
                                           (HL) to consider.
3D                  DEC A
CD8435              CALL E.B384,T_COLOUR   If all 8 bits of (HL) have been dealt
                                           with: the colour and attribute bytes
                                           and point HL to next byte from screen
F5                  PUSH AF                Stack screen-byte pixel counter
10B5                DJNZ YELOOP_A          Duplicate pixel as many times as
                                           is required
F1                  POP AF                 A= screen-byte pixel counter
C1                  POP BC                 B= number of times each pixel must
                                           be duplicated
10                  DEC D
2080                JR NZ,YELOOP_3         Repeat this procedure for all pixels
                                           within current pixel-layout row
FE08                CP 08
2808                JR Z,YWALLBNA          Jump if HL points to a new byte
CB06     YWALLBNE5  RLC (HL)               This loop re-ellipses (HL)
30                  DEC A                  so that all pixels are back in
2DFB                JR NZ,YWALLBNE5        the right place.
CD8435              CALL E.B384,T_COLOUR   Colour in the last attribute.
E1       YWALLBNA   POP HL                 HL= points to first screen byte
                                           affected in current row
D1                  POP DE                 DE= points to current row of
                                           pixel-layout
C1                  POP BC                 B= current row number
                                           D= column number of first pixel
                                           affected in current row.
```

```
CD5C00              CALL D05C,NEW_PIX      Point HL and E one pixel down
DDCB0046            BIT 3,(Z_FLAG)
2808                JR Z,TXP_3             Jump unless printing in italics
DDCB004E            BIT 1,(Z_FLAG)
C9D4                JR NZ TXP_E            Jump if using full space
DDCB0066            BIT 4,(Z_FLAG)         Test NEW/EVEN ROW flag
C4131D   TXP_2      CALL NZ,D31D,LEFT_PIX  If reqd, point HL and C one pix left
F5C5D3   TXP_3      RRC (HL+D)
20B0                JR NZ,YELOOP_E         Repeat current pixel-layout row
                                           as many times as is required
15                  DEC DE                 DE: points to next pixel-layout row
08                  EX AF,AF'
3D                  DEC A
20B0                JR NZ,YELOOP_1         Repeat procedure for all rows
                                           of pixel-layout
C9                  RET
```

```
                    ORG E414
F5       TX_CHRSUB  PUSH AF
E5                  PUSH HL
D5                  PUSH DE
E5                  PUSH HL                Stack all registers
E5                  PUSH HL                Stack HL again.
EA5F5D              LD HL,(MASK_T)
E3                  EX (SP),HL             Stack system variables MASK_T and
                                           P_FLAG. HL now restored
E5                  PUSH HL
217FFF              LD HL,7FFF
229D5C              LD (MASK_T),HL         Set INK 8; PAPER 8; BRIGHT 8;
                                           FLASH 8; OVER 1; INVERSE 0
E1                  POP HL
115C45              LD DE TO_PIXEL         Point HL to pixel layout for current
CDB185              CALL E5B1,T_PRINT      Print the current onto the screen
E1                  POP HL
229D5C              LD (MASK_T),HL         Restore original colours.
E1                  POP HL
D1                  POP DE
C1                  POP BC
F1                  POP AF
C9                  RET
```

```
                    ORG E434
3A5385   GET_WIDTH  LD A,(WIDTH)           = width of character (in squares)
F5                  PUSH AF
5F                  LD E,A
87                  ADD A,A
87                  ADD A,A
87                  ADD A,A                A= 8*(WIDTH)
CBCB005C            SET 2,(Z_FLAG)
9A1                 JR Z,DEC_WID_7         Jump unless or mg 7-bit type of co
93                  SUB E                  In which case A= 7*(WIDTH)
D1       DEC_WID_1  POP DE
C9                  RET
```

```
                    ORG E445
D5       TC_RIGHT   PUSH DE
CD3484              CALL E434,DEC_WIDTH
5F                  LD E,A                 E= character width in pixels.
87                  ADD A,A                A= twice this width
81                  ADD A,C
3002                JR C,TC_1              Jump if cursor might not possible
93                  SUB E
4F                  LD C,A                 C= new column number of cursor.
C1       TC_1       POP BC
1624                JR J_FIXADDR
D5       TC_LEFT    PUSH DE
CD3484              CALL E434,DEC_WIDTH
5F                  LD E,A                 E= character width in pixels.
79                  LD A,C                 A= current cursor column number
93                  SUB E                  A= new cursor column number.
D1                  POP DE
D8                  RET C                  Return if cursor left not possible.
4F                  LD C,A                 C= new column number of cursor.
1B09                JR J_FIXADDR
D5       TC_DOWN    PUSH DE
CD3D15              LD A (HEIG T)          A= character height in squares
87                  ADD A,A
87                  ADD A,A
87                  ADD A,A
5F                  LD E,A                 E= character height in pixels
87                  ADD A,A                A= twice this height
80                  ADD A,B
FE08                CP 08
3C08                JR NC,TC0_1            Jump if cursor down not possible
93                  SUB E
47                  LD B,A                 B= new row number of cursor
D1       TC0_1      POP DE
18D8                JR J_FIXADDR
```

```
D5          "_F         PUSH DE
3A0161                  LD A,(HEIGHT)          A:= character height in scanns
81                      ADD A,A
87                      ADD A,A
87                      ADD A,A
5F                      LD E,A                 E:= character height in pixels
78                      LD A,B                 A:= current row number of cursor.
93                      SUB E                  A:= new row number of cursor.
D1                      POP DE
D8                      RET C                  Return if number up not possible
47                      LD B,A                 B:= new row number of cursor
CD4198      J_PIXADDR   JP 9861,PIX_ADDR       Calculate HL:= address of screen-byte
                                               containing cursor, and return.
```

```
                        SBC A,B.
7E          TX-Y_CHECK  LD A,(HL)              A:= character width (or height)
A7                      AND A
B8                      JR Z,TX_1              Jump if width (or height) zero.
FA10                    JP M
B8CE                    JR C,TCH_P             Jump if width (or height) valid.
3607        TCH_1       LD (HL),01             Set width (or height) to 01
23          INC_P       INC HL
3600                    LD (HL),00             Reset high byte.
23                      INC HL
C9                      RET
            PRINT_CHAR  PUSH HL
E5                      LD HL,HEIGHT
CD8280                  CALL 8280,TEST_CHTK    Process valid character height
CD8286                  CALL 8286,TEST_CHLEN   Ensure valid character width
E1                      POP HL
AF                      XOR A                  A:= 00.
CBC6CB46                RES 0,(J_FLAG8)
D8DC                    JR Z,TCP_1             Jump unless printing in italics.
3A0383                  LD A,(WIDTH)           A:= character width in squares
87                      ADD A,A
87                      ADD A,A
CBC6CB4E                SET 1,(J_FLAG8)
20D1                    JR Z,TCP_1             Jump if using half-slope
87                      ADD A,A
B9          TCP_1       CP C
3001                    JR C,TCP_2             Jump unless current cursor position
                                               overlaps left hand edge of screen
AF                      LD C,A                 Cursor now as far left as possible
CD3434      TCP_2       CALL 3434,SET_WIDTH    A:= character width in pixels
81                      ADD A,C
3004                    JR NC,TCP_3            Jump unless current cursor position
                                               overlaps right hand edge of screen
91                      SUB C
3084                    NEG
AF                      LD C,A                 Cursor now as far right as possible.
3A0183      TCP_3       LD A,(HEIGHT)          A:= character height in squares
```

```
87                      ADD A,A
87                      ADD A,A
87                      ADD A,A                A:= character height in pixels
B0                      ADD A,B
FE80                    CP 80
3006                    JR C,TCP_4             Jump unless current cursor position
                                               overlaps bottom of screen.
90                      SUB B
2844                    NEG
C680                    ADD A,80
47                      LD B,A                 Cursor now as far down as possible
1007        TCP_4       JR J_PIXADDR           Calculate HL:= address of screen
                                               byte containing cursor, and return.
```

```
                        JMP EADC
3096        T_BIT       LD A,04                Bit 2 of A set
1606                    JR DOLD_T
3006        BOLD        LD A,00                Bit 3 of A set
EE80        BOLD_T      XOR (J_FLAG8)          Complement required bit
32C8CB                  LD (J_FLAG8),A
C9                      RET
18000046    ITAL_OFF    RES 0,(J_FLAG8)        Signal "Not printing in italics".
C9                      RET
CBC6CB46    ITAL_ON     RES 1,(J_FLAG8)        Signal "Not using full slope"
1804                    JR ITAL_1
CBCECB4E    ITAL_FU     SET 1,(J_FLAG8)        Signal "Using full slope".
CBCECB46                SET 0,(J_FLAG8)        Signal "Printing in italics"
1B9F        ITAL_1      JR TEST_CPOS           Adjust cursor position if necessary.
22147B      TEST_EXIT   LD (CURSOR),HL         Store final position of cursor.
ED43163B                LD (CURSOR-2),BC       Store final cursor coordinates.
CD6D0D                  CALL 0D6D,CLS_LOWER    Clear lower part of screen
F1                      POP AF                 Keep return address TEXT_LOOP
C9                      RET                    Return to 1B8 Main Loop.
```

```
                        JMP HALT
CD6184      ASK_1       CALL 8461,SHOW_CURS    Ensure that cursor will fit on screen.
CD1A84      ALT_SIGN    CALL 841A,XL_CURSOR    Print cursor on screen.
FDCBCB7AAC              RES 5,(FLAG0)          Signal "Ready for a new key".
FDCBCB6EA8  ASK_P       BIT 5,(FLAG0)
28FA                    JR Z,ASK_P             Wait until a key is pressed. Note
                                               that bit 5 of FLAG0 remains SET
                                               on exiting this loop.
C5                      PUSH BC                Stack cursor coordinates
E5                      PUSH HL                Stack cursor address
CD8A0D      ASK_2       CALL 0D8A,KEY_SCAN     A:= keyboard code for this key
E1                      POP HL                 HL:= cursor address
C1                      POP BC                 BC:= cursor coordinates
79                      LD A,B                 A:= keyboard code of key pressed.
CD1A84      ASK_3       CALL 841A,TX_OUTSCR    "Redraw" cursor from screen.
FE06                    CP 06
20C5                    JR NZ,ASK_5            Jump unless SPACE pressed.
FDCBCB7AAB              RES 5,(FLAG0)          Signal "Ready for a new key"
C9                      RET                    Return to TEXT_LOOP
FE04        ASK_5       CP 04
2B08                    JR NZ,ASK_6            Jump unless 5 pressed with either
                                               shift (CURSOR LEFT)
3A0383                  LD A,(WIDTH)           A:= width of character.
3D                      DEC A
20E5                    JR Z,ALT_SIGN          Jump back if width=1.
320383                  LD (WIDTH),A           Decrement width
18D8                    JR ALT_SIGN
FE05        ASK_6       CP 05
20F5                    JR NZ,ASK_8            Jump unless 8 pressed with either
                                               shift (CURSOR RIGHT)
3A0383                  LD A,(WIDTH)           A:= width of character.
3C                      INC A
FE10                    CP 10
3004                    JR NC,ALT_SIGN         Jump if width greater than 3.
320383                  LD (WIDTH),A           Increment width.
18BC                    JR ASK_1               Jump back to check position
                                               on screen.
```

```
F803    ASE_5     CP 05
2088              JR NZ,ASE_6          Jump unless 5 pressed with either
                                       shift (CURSOR UPWD).
3A0185            LD A,(HEIGHT)        A:= height of characters.
3C                INC A
FE10              CP 10
D2B3              JR NC,ALT_NEXT       Jump back if height greater than 9.
320185            LD (HEIGHT),A        Increment height.
18A8              JR ASE_1             Jump back to check position
                                       on screen.
FE08    ASE_6     CP 08
C8                RET NZ               Return unless 7 pressed with either
                                       shift (CURSOR DWN). Note that check
                                       bit 5 of FLAG0 is set, the key
                                       pressed will be re-interpreted
                                       within the main TEXT LOOP
3A0185            LD A,(HEIGHT)        A:= height of characters.
3D                DEC A
20A5              JR Z,ALT_NEXT        Jump back if height=1.
320185            LD (HEIGHT),A        Decrement height.
18A0              JR ALT_NEXT
```

This is the main entry point for TEXT MODE. When you press the TEXT key (key F) while using the Light Screen Designer control commences from this point. On entry B contains the row number, and C the column number, of the edit cursor. HL points to the byte from the screen which contains this cursor

```
                  ORG 8561
CD8184  TEXT_MODE CALL 8484,TEXT_CHK   Move cursor if necessary
C5                PUSH BC              Stack coordinates.
E5                PUSH HL              Stack cursor position
CD0C0C            CALL MESSAGE
0D                DEFB 0D              Print "New in text mode".
E1                POP HL
C1                POP BC
C5      TEXT_LOOP PUSH BC              Stack coordinates
E5                PUSH HL              Stack cursor position
3A3058            LD A,(FLAG0)
F5                PUSH AF              Stack FLAG0 (in particular bit 5)
AF                XOR A                A:= 00.
D3E16             CALL 1601,CHAN_OPEN  Select channel zero (lower screen)
F1                POP AF
CB2858            LD (FLAG0),A         Restore bit 5 of FLAG0
01E101            LD BC,[illegible]
CDFB0A            CALL DAWS,AT_BC      PRINT AT 1,174;
3E40              LD A,"@"
FDCB01FF          BIT 3,(IY+01)
2808              JR Z,TEXT_1          Jump unless CAPS LOCK on
3E43              LD A,"C"
FDCB074E  TEXT_1  BIT 1,(IY+07)
2802              JR Z,TEXT_2          Jump unless in GRAPHICS mode
3E47              LD A,"G"
CF        TEXT_2  RST 10               Print cursor mode.
115A40            LD DE,4A5A           D:= "Z", E:= "J".
DDCB0243          BIT 1,(IX+FLAG0)
2808              JR Z,TEXT_3          Jump unless using full alpha.
1646              LD D,"F"
DDCB0246  TEXT_3  BIT 0,(IX+FLAG0)
CDF183            CALL 8371,PR_EX_DE   Print timite status
114343            LD DE,4343           D:= "C", E:= "C"
DDCB0256          BIT 2,(IX+FLAG0)
CD7183            CALL 8371,PR_EX_DE   Print compressed-letter status
```

```
11E742            LD DE,4242           D:= "B", E:= "B".
DDCB0206          BIT 3,(IX+FLAG0)
CD7183            CALL 8371,PR_EX_DE   Print theme status.
E1                POP HL
C1                POP BC
CD1424            CALL 2414,TX_CURSOR  Draw t  text cursor.
C5                PUSH BC
E5                PUSH HL
CD0883            CALL 8300,T_KEY      Wait for key pressed, A:= chr code
E1                POP HL
C1                POP BC
CD1424            CALL 2414,TX_CURSOR  "Undraw" the text cursor
18E2E5            JR NZ,TEXT_LOOP      Check TEXT_LOOP as return address.
F5                PUSH AF              Stack key pressed.
E5                PUSH HL
C5                PUSH BC
3E02              LD A,02
D3E016            CALL 1601,CHAN_OPEN  Select channel 2 (main screen)
AF                XOR A                Set the zero flag
CD5B0D            CALL DUSR,TEMPS_V    Reset OVER and INVERSE from
                                       permanent colours
C1                POP BC
E1                POP HL
F1                POP AF               A:= key just pressed
FE20              CP 20
300F              JR NC,TEXT_A         Jump unless A contains a ctrl code.
E5                PUSH HL
6F                LD L,A
2600              LD H,00
11E182            LD DE,82E8
29                ADD HL,HL
19                ADD HL,DE            HL: points to subroutine address
5E                LD E,(HL)
23                INC HL
56                LD D,(HL)            DE:= subroutine address
E1                POP HL               Restore HL value
E5                PUSH HL
CF                RST 10               Jump to required subroutine.
```

```
C5      TEXT_4    PUSH BC
E5                PUSH HL
CD4C85            CALL 8540,V_LOCATE   HL:= address of pixel layout.
ED                EX DE,HL             DE:= address of pixel layout.
E1                POP HL
C1                POP BC
C5                PUSH BC              Stack screen coordinates.
CD6183            CALL 8361,TX_PRINT   Print character on screen.
C1                POP BC               Restore cursor coordinates.
C34E84            JP 8445,TO_RIGHT     Move cursor right, if possible,
                                       and return
```

QL Matchpoint Competition

We've got 20 copies of this ace game to serve up for QL owners!

From Psion the people who brought you the wondrous QL Chess program (one of the first and still one of the best games programs for the QL) comes a conversion of their Spectrum game *Matchpoint*.

This tennis arcade/simulation game brings you all the excitement of Wimbledon to brighten up a few dreary winter evenings. Matchpoint allows you to play against the computer or another human opponent and there's a range of skills and tactics to be mastered that will keep you busy for a long long time. As you get better you'll be able to progress through the early rounds of the tournament right through to the finals and the level of competition gets higher every step of the way!

As soon as we saw Matchpoint running on the QL we thought it would be a good idea to see if we could arrange a competition of some sort and after we made a few approach shots Psion responded by lobbing 20 copies of the game back into our court. Then just to finish off the rally they suggested we make a special offer of £1 off the retail price (£14.95) just for readers of ZXC.

So to enter the competition all you have to do is answer a few questions (about tennis of course) and send your answers into ZXC. Or if you want to take advantage of our special offer then just send payment of £13.95 and the £1 voucher direct to Psion at the address listed on the voucher.

The questions

1) Name the current Wimbledon Men's Single Champion.

2) Who won the Wimbledon Ladies' Championship in 1977 (just as a hint it was a British player)?

3) Name the current British No 1 Men's player.

4) Is the Current Wimbledon Women's Champion
   a) John McEnroe?
   b) Martina Navratilova
   c) Ray Elder?

If you've got all the answers write them on the back of an envelope or postcard and send it to Matchpoint Competition, ZX Computing, 1 Golden Square, London W1R 3AB.

The rules

- This competition is open to all UK and Northern Ireland readers of ZX Computing except employees of Argus Specialist Publications, their printers, distributors, employees of Psion Ltd and anyone else connected with the competition.
- All entries must be postmarked before 31st of January 1986. No correspondence will be entered into with regard to the competition and it is a condition of entry that the Editor's decision is final.
- As long as each entry is sent written on the back of a separate postcard or envelope then there is no limit to the number of entries that may be submitted by an individual.
- The winners will be notified by post and the results published in a future edition of ZX Computing.

Wish I could play as well as the QL

The Perfect Keyboard

John Wase discusses how to customize your keyboard.

It was this lady on the Oxford train. She was telling me how she was involved in a charity which deals with handicapped children's reading problems. Yes... she said, we've got a Spectrum and like it very much it's inexpensive and so easy to use. I thought about that several times in the following week you know, she's right. I suppose that's why I keep adding bits onto mine — essentially it's a basic, inexpensive and rather nice machine, even if you can't type with it. That was my problem when I first wanted to use it as a word processor. So I seized and read as many add on keyboard reviews as I could. Some of these are listed below. The list is by no means exhaustive. Several of them mention touch typing being possible for a number of keyboards, but essentially this is just not true. Let's look why.

Figure 1. DK Tronics keyboard

Qwerty . . .

When you learn to touch type the home keys for the left hand are ASDF and those for the right hand are JKL. Each of the four fingers thus rests on a key. The index (first finger) is also used for G (left hand) and H (right hand) respectively. To access the rows above and below, the hands move up and a little left or down and a little right.

To convert the keys accessed by the left hand to capitals or equivalent, the shift key at the other end of the board is depressed, using the little finger of the right hand. And vice versa. So, to get any capitals properly, you need a shift key at each end of the bottom line, symmetrically placed, and situated conveniently for the little finger of either hand. Exit most add on keyboards recommend for touch typing.

However, worse is to follow. The Spectrum was designed with the minimum number of keys. A QWERTY keyboard has semicolon as the home key (little finger, right hand side) and a 'single entry' full stop and comma on the bottom line. These are missing on many add on keyboards, but it is very difficult to touch type without, at any rate, the full stop and comma.

Finally, because each key has to be used for much more than just lower case and caps, additional symbols are obtained through symbol shift, through extended mode (caps shift *and* symbol shift), and through symbol shifted extended mode. A few of these are needed for normal typing (e.g. !) and Tasword uses double shift for some control characters. So you must have a symbol shift at each end, again preferably symmetrically placed and operated by the little finger (like the caps shift). Oh, and of course you need a space bar.

Membrane Misery

Well, when I looked, I could find no keyboard that fulfilled all these criteria. So I needed one that I could modify. This cuts down the choice a bit, too! If you don't happen to have a joystick you will know that over enthusiastic pounding of the cursor buttons eventually does them in. If you then prise apart the Spectrum case in your fury you will find the (damaged) membrane. This consists of three plastic sheets glued together. The top one and bottom one have circuits printed in their inner surfaces, the middle one is blank, but the holes cut where the circuits cross, corresponding with the rubber buttons above. So the two outer pieces of membrane are forced together when the button is pressed, making the appropriate contact. This principle is also used in some add on keyboards (the Saga Emperor 1, for instance). And because of this membrane *problem*, they are *very* difficult to modify, to modify a key board, it must essentially consist of separate keys mounted on a circuit board.

Padding along

As far as I was concerned, I had one additional criterion to meet. I often have to enter quantities of numeric data, either as tables in the text or as a tabular material for calculations. So for me a numeric pad was particulary useful.

At the time I was buying, there were far fewer keyboards available than now, and I recall considering two. Transform's was around £70, whilst DK Tronics new space-bar board was around £45 (it's now nearer £30). Both of these have separate keys. Those on the Transform board are of the plated contact sort whilst those on the DK Tronics board are of the cheaper individual membrane deforming type. These are quite good enough for many purposes, and the price was attractive. So I bought a standard DK Tronics board, this

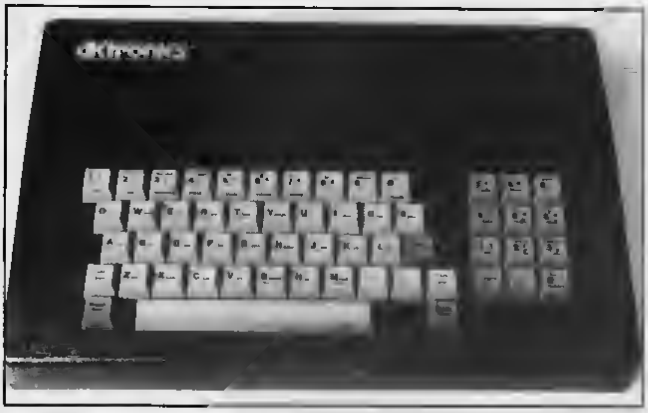


Figure 2 My first modification

is probably the most popular add on keyboard in use

Secretarial scrutiny

The first thing I did was to enlist the aid of our professional office secretaries I had half a dozen of them pound the keyboard for a while before modification None of them liked the touch very much but reckoned they could get used to it However, their comments on the original arrangement of the keys were unprintable and gave me the confidence to go ahead with my first set of modifications

Our Editor often mentions how helpful DK Tronics are I can also vouch for this I explained what I wanted to them and they produced a circuit diagram and spare keys enabling me to fit my single key entry full stop and comma and the extra symbol shifts The keyboard (first modification) now looked like the second picture (Fig 2)

Full of delight — (yes bless you Dk Tronics — it worked!) — I produced my modified keyboard for the secretaries to pound Pride becomes before a fall! They all gave it the thumbs down When I got down to it there were two further problems The first and major one was that I couldn t count Look at a standard QWERTY keyboard On the bottom line after M and N there s a comma, and a full stop then at least one more key before the caps shift (very commonly ? with '/' when shifted) I had put the caps shift there hadn t I! Because the caps shift was in the wrong place they felt very uncomfortable and unfamiliar and somehow they were all cramped up — several complained that it felt cramped The second problem is that the 'enter' key is next to the L where one normally has a , key and a couple of others to the right for that matter And the same on the rows above the secretaries complained that their fingers fell off the end of the keys — somehow it didn t feel right at all

So I set out to modify the board again Back to DK Tronics Please sirs can I now ? No you can t they said No matter how many diodes you f t you won t get the single entry keys you want can t be done

That did it!

Right note, wrong key

The shifted keys on the Spectrum are obtained by first pressing one key and holding whilst holding another To simulate this without the use of diodes one needs a double pole switch in which one set of contacts is made before the other and which matches the originals in shape size and feel Armon Electronics DK Tronics suppliers were very helpful The first batch of keys they supplied were not double pole (although they had thought they were) but did reveal that I had got another unsuspected problem At sometime DK Tronics had changed their key pattern and my board was about the last made with the now obsolete keys the ones used are now about 1 5 mm longer After several months they managed to get a sample of double pole keys from Japan but my personal gremlin was by now having too much fun to give up Although double pole these required far too much pressure to get second contact (which was right at the bottom of the travel) And these were the only keys Armon could supply

I then tried National Switch Factors at Keighley who were also very helpful and sent me several sorts of double pole keys However these all worked rather like hinges and were

Figure 3 The finished job

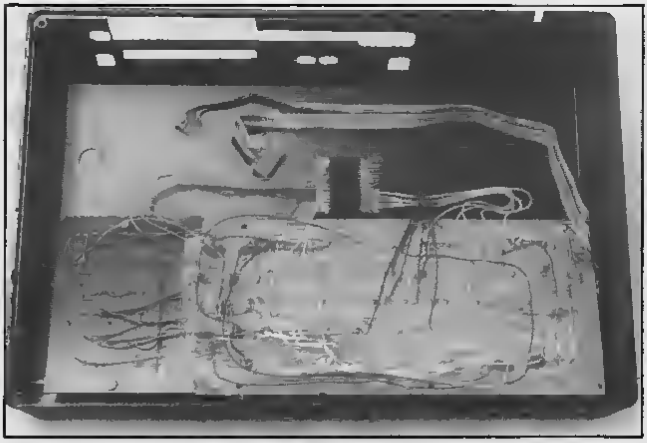


Figure 4 The spider web made connected up to the Kappa interface

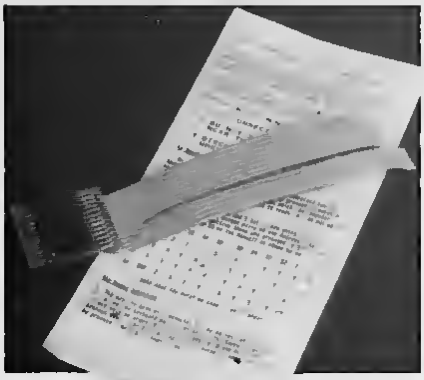
the wrong size and pressure. It looked like the end of the road. What I didn't know at the time was that there are keys of the type I wanted available. For instance... more recently the keyboard which was made by Cheetah (and is now marketed by LMT) uses this principle. And I suspect that Cherry keyboards also use this type of key for some applications. However, at the time, just as I was despairing a friend came up with a new approach, and so I abandoned my search for double pole keyswitches.

Key to the problem

He recommended a little gadget designed by one Steve Drain and marketed by Kappa keyboards. This has a row of terminals on either side. On one side you connect all the input lines into the keyboard. On the other you can connect lines to single key entry, symbol shifted or caps shifted keys. A diagram and instructions are provided and it is all there, but I found it not particulary easy to follow. Fortunately I had to visit the Evesham Micro Centre's branch at Cotteridge (famous for there Interface III) and they gave me an old Spectrum membrane of the type mentioned earlier. Tracing the circuits on this helped immeasurably. However, I still needed some extra keys of the old pattern. Back to DK Tronics.

At that stage I shouldn't have rung up our Editor and promised this article, should it? DK Tronics scoured their depot and their keyboard factory, but no luck. Weeks passed, no keys. In desperation I ordered a dozen of the new pattern. After all, I needed to interpose extra keys where the numeric pad once was, so I had to move it along a bit. I therefore sacrificed it, remade it with the new keys on a spare piece of board and stuck this on under a cut out on the original board. Thus the new keys were mounted slightly lower, which just about compensated for their increased height. This was a much easier alternative to grinding all the caps down and released a dozen old pattern keys to use as the extra keys on my modified board (I felt rather pleased about that).

Figure 5 The Kappa kb



So at last I had the thing together. The DK Tronics case needed additional carving (fortunately it's very receptive to this sort of ill treatment, being ABS plastic and therefore relatively easily worked). I then had a major hiccup because it wouldn't work. I contacted Steve Drain who resoldered my connections correctly (he has apparently had bad press recently over some postal problems, but I found him very helpful). And there we were, at last a working keyboard.

Happy endings

A few final comments. It's much easier to have a keyboard to modify rather than to start from scratch. Dk Tronics proved very easy to alter and has a reliable name. New keyboards are available from a variety of suppliers (e.g. Armon Electronics); alternatively, second hand ones are available. Do make sure that the keys are of the contact variety, not capacitance or Hall effect type and that sufficient spare keys are available. You will have to solder all the data and address lines into the kappa interface, even if you don't need all the outputs. And finally, don't try this device unless you are bold and prepared to use a soldering iron. Happy keyboarding.

Acknowledgements

I am grateful to the help of a number of people, in particular Keith Thompstone of DK Tronics, Armon Eletronics Ltd, 109 Wembley Hill Road, Wembley, National switch Factors, Keighley and Steve Drain of Kappa keyboards, 14 Pauls Mead, Portland, Dorset, DT5 1JZ.

Literature

Some reviews of add on keyboards may be found in Your Spectrum (7) Sep 1984 pp28 31, Sinclair Answers Jan/Feb 1985 pp 4 6, Sinclair User Jun 1984 pp45 47. Additional information is provided in ZX Computing Apr/May 1984 pp53 55, Oct Nov 1984 p18, Feb/Mar 1985 p80, Apr May 1985 p118 and in Sinclair User Aug 1984 pp29 31, oct 1984 p23, Dec 1984 pp56 57 59, Jan 1985 p25, Feb 1985 p47, Jun 1985 p47, Jul p41, Aug p139 40.

Midi Control of the DX7 and TX7.

We try a Spectrum MIDI package which makes DX7 programming easier, and TX7 editing possible.

At over £1400 we did not consider DX7 software to be of interest to many readers but from the number of letters we received we realised we were wrong!

The TX7, a DX7 without keyboard designed to be added to a DX7 and priced at £699 was more feasible but none — including Yamaha it seems thought it could be programmed without a DX7. But we discovered that it could!

I purchased a TX7 a little while ago. A DX7 was out of my price range but I reasoned I could link it to the Sid keyboard we used for an earlier review and this proved to be so. Although the voices supplied programmed into the unit were more than satisfactory I soon became aware that I only had access to about 60% of the machine's capabilities. So I rang up Mike Beecher of Electromusic Research and neither he nor the programmer of their DX7 software knew whether it would function with the TX7 although they couldn't see why not. The programs arrived and I set about experimenting.

The programs

Throughout this article I will be referring to the TX7. For DX7 owners ALL the operations and functions of the software are the same and work perfectly — I managed to borrow a DX7 in order to confirm this. The three programs marketed by EMR are

1 A voice and function library

This consists of seven banks of 32 sounds. These are transferred to and from the DX/TX via the EMR MIDI interface.

This was an immediate bonus to the TX as the only other way of doing this was the cassette interface fitted and although tape sound libraries probably exist I was unable to find any.

Now I had access to 224 alternative sounds. The sounds supplied are interesting ranging from the pure effects such as birds to some beautiful and pleasing musical sounds. I was told that they had been collected from many sources from all over Europe in themselves they are a valuable addition to the TX/DX. If your use of the equipment is studio or home based then having the Spectrum connected permanently with the full library in memory is satisfactory as loading and finding a sound from a bank takes around twenty seconds!

However if you are using your machine on the road or want to use your Spectrum to run another MIDI program such as EMR's Performer — a brilliant 8 track real time polyphonic tape recorder simulator then this is not often convenient. To get around this you can use this program to compile a bank of the 32 most frequently used sounds and keep it in the DX/TX's memory permanently. This is a little time consuming and rather fiddly requiring loading a bank to the TX, retrieving the single voices required back to the Spectrum saving onto tape one at a time until all 32 are on tape. Then by loading each voice back into the Spectrum transferring to the DX/TX and storing into the required memory number the final compilation of the 32 voices can be made.

2 Function Perameter Store

A fundamental difference between the TX7 and the DX7 is that the TX7 provides a separate set of function information for each voice whereas the DX7 has only one which must be changed if necessary when a new voice is used. This means that this program is not so essential to TX7 owners especially as each function is alterable from its own control panel. However the easy to use menus plus the means of displaying all the information at once on the screen proved very useful and greatly eased the modification of the values.

A big bonus for DX7 owners is the option to load one of the bank of 32 function patches into the DX7 from the program change of another MIDI instrument thus saving the need to reprogram them manually. After each alteration of a function the patch is sent to the TX/DX so that you can play it and get an instant audio feedback of what your modification sounds like.

3 Voice Editor

This is the chief program for DX/TX owners in that it displays all the information clearly and graphically both in bar graph and line graph form. As the actual programming of the DX/TX voices is well known for its complexity the program should be received with open arms by those who are still struggling. The fast access to all the parameters which can be seen at a glance, compared and altered almost makes this task easy!

After each section has been changed the new information is sent to the TX/DX and can be played so you can hear the effect you have created. For DX7 owners this program will aid your sound creation if you are experienced or make it much less daunting to learn how to program sounds.

TX7 Specific problems

Because the TX7 does not have a keyboard and is connected by the MIDI IN to the controlling keyboard I had a problem in that every time I wanted to use the program I couldn't play the sounds and vice versa. This meant a lot of pulling out and plugging in of the 5 pin Din leads. Not a good idea.

I got around it by purchasing the Yamaha YME 8 MIDI box. This allows two MIDI INs to be switch routed to two banks of four MIDI OUTs. To swap from computer to keyboard was now only a matter of flipping two switches. Expensive at £55 but cheaper than replacing damaged leads and sockets, also it come in useful for other MIDI operations.

Yamaha say in their TX manual — as the TX7 voices are not programmable there is no need to give details of programming them". This means that you have no clue how to go about creating sounds. If you have a good idea of sound creation on digital synths then you are likely to be able to work it out by trial and error.

Whatever your knowledge it is great fun and satisfying (not to mention frustrating) using the Voice Editor program to experiment with.

Plus . . .

ZXC has managed to organise a special offer in conjunction with Electromusic Research. Individually, the Function Library, Function Editor, and Voice Editor programs cost £24.95 each — which would make a total of £74.85 for all three. ZXC is able to offer its readers all three programs for the bargain price of just £49.95, representing a saving of £25 (hang on a sec) £24.90!! (EMR's own Midi Interface is also available for £79.90)

**** Special Offer ****
**** Save £24.90 ****

Just for readers of *ZX Computing* we're offering Electromusic Research's Function Library, Function Editor, and Voice Editor all together for the price of just £49.90.

To order these programs just send this coupon to
EMR Ltd. 14 Mount Close, Wickford, Essex

Name

Address

Binary and Hex

The Arithmetic of Computing

by
Carol Brooksbank

It might seem odd to start an article about binary and hex by talking about decimal arithmetic but the processes involved in all three systems are the same. Only the number of digits used is different. The trouble is that we are all so expert in using decimal counting that we no longer think about the mechanics of what we are doing. Almost everyone can count from 1 to 100 without worrying about the processes involved, and even someone with no head for figures can add 1 to 99 and get the right answer without a second thought about what they did. They just know how to do it. But if you understand what is happening when you count in decimal, you are half way to becoming fluent in binary and hex, so I am going to analyse decimal counting. Please don't skip this bit just because it seems very elementary. You will get to grips with the other systems much more easily if you read on.

Decimal

In decimal arithmetic there are 10 digits which are always used in the same order when counting:

0 1 2 3 4 5 6 7 8 9

Because of the need to use numbers higher than 9, a column system is used. Imagine the digits arranged in a vertical column. When 9 is reached we have run out of digits, so a second column is brought in to the left of the first one, and this new column is assumed to hold 0. To progress beyond 9, 1 is added to the amount in the new column, and the original one is returned to 0. This gives the number we call ten.

0
1
2
3
4
5
6
7
8
09
10

You can then count on until you reach 9 again in the right hand column, when you repeat the process, adding 1 to the left column and returning the right one to 0.

19
20

This process can continue until 99 is reached, when you need to bring in another column to the left.

98
099

Now, as before, you add 1 to the leftmost column and return all the others to 0.

099
100

You can go on like this for as long as you need. Every time you add 1 to a column, you return all those to the right of it to 0, and every time all the columns in use reach 9, you bring in another to the left. In this way any number, as big or small as you wish, can be expressed.

Because there are 10 digits in use, each new column is worth 10 times the one on its right. The number 546,672 is actually made up like this:

100,000 x 5	=	500,000 +
10,000 x 4	=	40,000 +
1,000 x 6	=	6,000 +
100 x 6	=	600 +
10 x 2	=	20 +
1 x 7	=	7
TOTAL		546,627

This columns system is exactly the same in binary and hex, so the only new factor is the number of digits.

Binary

In binary arithmetic there are only 2 digits, 0 and 1. As before, you count in one column until you run out of digits, when you introduce a new one to the left. The difference is that you run out of digits much more quickly in binary.

Binary	*Decimal*
0	0
01	1
10	2

The number reached at this point in binary, 10, is not ten. It is one oh binary. Ten is a name reserved for one oh decimal, and in order to avoid any confusion, you should always think of the binary numbers as one oh binary, one one binary and so on.

You carry on counting in binary in exactly the same way as in decimal, introducing new columns as they are needed.

11	3
100	4
101	5
110	6
111	7
1000	8

You will see by now the great disadvantage of binary. With so few digits the numbers quickly become longer, so that the number expressed as '8' in decimal is a four figure number in binary. In fact, because the numbers are long and in order to reduce confusion between systems, it is usual to express all binary numbers up to 255 decimal as eight figure numbers.

8 decimal = BIN 00001000
255 decimal = BIN 11111111

As there are only 2 digits, each column in binary is worth twice the column to its right.

128	64	32	16	8	4	2	1
1	1	1	1	1	1	1	1

To convert a BIN number to decimal, you work as follows:

BIN 11111111 =

128 x 1	=	128 +
64 x 1	=	64 +
32 x 1	=	32 +
16 x 1	=	16 +
8 x 1	=	8 +
4 x 1	=	4 +
2 x 1	=	2 +
1 x 1	=	1 +
TOTAL		255

In binary, just as in decimal, you can introduce as many columns as you need to express a number of any size. Take the decimal number 12345, for instance, in binary, this is:

0 0 1 1 0 0 0 0 0 0 1 1 1 0 0 1

Since binary is such a cumbersome system with long awkward numbers, what use is it? Well, in ordinary everyday life, not a lot, but in the world of electronics, it has one great advantage. Because there are only two digits, it is possible to express the numbers electronically.

Imagine that you have a bank of eight electric wires, each equipped with a switch. If you switched the switches so that 0 was represented by an inert wire (switch off), and 1 was represented by a live wire (switch on), you could express the binary form of any number between 0 and 255 decimal. Put very crudely, this is what happens inside your computer. You can think of each address in your computer's memory as a minute bank of 8 electric wires and switches. When you poke a number into an address, the switches are manipulated so that the pattern represents the binary form of your number. The particular combination of live and inert wires causes the computer to perform some operation. It is beyond the scope of this article to go any further into the workings of the computer, but I want you to understand the importance of binary arithmetic

to the computer world. Whatever form of counting you use to program your computer, decimal, hex or binary, it is the binary form which is important and the binary form is the one stored in the memory. We use the other forms because binary is so unwieldly for we humans, so we let the computer do the convers on.

As each address, or byte in the computer s memory can only hold 8 binary digits, bits, what happens if you w sh to store a number like 12345 decimal which has more than 8 bits? The computer takes the 16 bit form of the number, and cuts it in half ie 0011000000111001 becomes 00110000 00111001. It then stores each half separately. The second half, the low byte, is stored first, and the first half, the high byte, in the following address.

This s where decimal, which is more familiar to humans, becomes awkward to use in relation to computers. The low byte, BIN 00111001, is 57 decimal and the high byte, BIN 00110000, is 48 decimal. At first glance there seems to be very little connection between 57 and 48 and 12345. In fact, you can find the decimal by multiplying the h gh byte by 256 and adding the low byte.

256 x 48	= 12288
ADD	57
TOTAL	12345

Th s lack of an obvious connection between a number and its low and high bytes in decimal is one of the reasons why many machine code programmers prefer to work in hex, which is less unwieldly than binary and more convenient than decimal for programming. But before I go on to talk about hex, I am going to give you some homework. If you plan to do any machine code programming, you will save yourself a lot of looking up in tables if you learn by heart the binary forms of the decimal numbers 0 to 15, so try to memorise this little table.

BIN	DECIMAL
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	10
1011	11
1100	12
1101	13
1110	14
1111	15

Hex

In hex you have 16 digits — 0 1 2 3 4 5 6 7 8 9 A B C D E F. The column system for counting is used exactly as before, but instead of bringing in a new column after 9, as in decimal, you carry on until you reach F, and then introduce the new column.

HEX	DECIMAL
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
A	10
B	11
C	12
D	13
E	14
0F	15
10	16

Again, the number reached in hex is not ten, but one oh hex, and is equal to 16 decimal. Hex numbers are expressed as 10H or 0010H.

Each column in hex is worth 16 decimal times its right hand neighbour. The number 12345 decimal is 3039h and is broken down as follows.

4096	256	16	1
3	0	3	9

4096 x 3 =	12288 +
16 x 3 =	48 +
1 x 9 =	9
TOTAL	12345

A hex number containing some of the letter digits can be converted as follows.

4096	256	16	1
2	A	C	F

4096 x 2 =	8192 +
256 x 10 =	2560 +
16 x 12 =	192 +
1 x 15 =	15
TOTAL	10959

You will remember that we discovered earlier that the high and low bytes of 12345 were 48 and 57 respectively. We have since seen that the hex form of 12345 is 3039h. The hex form of 48d is 30h and 57d is 39h. You can see at a glance what the high and low bytes of a hex number are, without doing any calculations. From this, it follows that there is a direct connection between the binary and hex forms of a number which is much more obvious than the connection between the decimal and any other form (See figure 1).

Figure 1 Binary, hex and decimal comparisons

BIN 0011	= 03h	= 3d
BIN 0000	= 00h	= 0d
BIN 00110000	= 30h	= 48d
BIN 0011	= 03h	= 3d
BIN 1001	= 09h	= 9d
BIN 00111001	= 39h	= 57d
BIN 0011000000111000	= 3039h	= 12345d

Clearly, this makes life much easier for the machine code programmer. By using hex he can avoid all the calculations required to find the high and low bytes when working in decimal. Also, when he comes to type in the machine code listing, most of the numbers are shorter than the equivalent decimal ones so there is a saving in time too. In fact, after you have become familiar with hex you begin to wonder why decimal is the universally popular system. I suspect that is has something to do with the fact that we are all born with a built in decimal calculator — four fingers and a thumb on each hand — and everyone, including primitive man who invented counting, learns to count on their fingers. If we had three extra fingers per hand I believe that we should all be working away happily in hex and the genius who suggested that you could have a very good counting system with only ten digits would be quietly led away by men in white coats.

Meanwhile, computer programmers need to familiarize themselves with binary and hex. You simply need to become as expert with binary and hex as you are with decimal, and practice is the only way. You can help yourself by learning another conversion table (figure 2). It is very similar to the first one, but will allow you to convert between the three systems. In fact, you have very little extra to learn because decimal and hex figures are the same until you reach 10 decimal.

Can you do sums in hex? ▶

Yes of course and in exactly the same way that you do them in decimal Let us add 3039h and 7/FE3h

```
 3039
 7/FE3
 ------
```

9 + 3 = C (try not to work in decimal ie 9 + 3 = 12 convert it to hex = C Count it out in hex — 9 A B C You may need help at first and fingers are not much use as you haven t enough so write the hex digits out and count along them)

```
 3039
 7FE3
    C
```

3 + E = 11 Answer 1 and carry 1

```
 3039
 7FE3
   1C
    1
```

0 + F = F + carry 1 = 10

```
 3039
 7FE3
  01C
    1
```

3 + 7 = A + carry 1 = 8

```
 3039
 7FE3
 801C
```

I cannot make you an expert in hex just by writing this article It will depend on how much time and practice you are willing to put in Try devising sums for yourself You might even try writing the multiplication tables in hex I will start you off with the two times — you can work out the others

2 x 1 = 2
2 x 2 = 4
2 x 3 = 6
2 x 4 = 8
2 x 5 = A
2 x 6 = C
2 x 7 = E
2 x 8 = 10
2 x 9 = 12
2 x A = 14
2 x B = 16
2 x C = 18
2 x D = 1A
2 x E = 1C
2 x F = 1E

Try to get into the habit of doing all your calculations in hex rather than working things out in decimal and then converting the answer It is rather like learning a foreign language You cannot become fluent if you work everything out in English and then translate it You have to learn to think in the language You have to learn to think in hex

This is why I have not included a hex decimal conversion table in this article If you start to rely on one you will never really be able to work freely in hex and it will always be a foreign language It is much better to persevere with learning to count and calculate in hex even if you flounder a bit at first For those who find they simply cannot manage without a conversion table you will find one in almost any book on machine code programming But you will know that you have become fluent in hex on the day you no longer feel you need one

Figure 2

BIN	DECIMAL	HEX
0000	0	0
0001	1	1
0010	2	2
0011	3	3
0100	4	4
0101	5	5
0110	6	6
0111	7	7
1000	8	8
1001	9	9
1010	10	A
1011	11	B
1100	12	C
1101	13	D
1110	14	E
1111	15	F

Philips Data Recorder

Those nice people from Philips sent us one of their new D6450 Data Recorders to look at recently and very nice it looks too The trouble was that when we got set to try it out on a few programs we realised that there s no way of plugging it directly into the mains You can put half a dozen batteries into it but that s bound to become expensive after a while (unless you use rechargeable batteries) and you ve also got the added hassle of making sure that the batteries are always fully charged or you ll get loading problems

Your only other alternative s to go out and buy a separate 9v DC power supply which will cost you an additional £10 or so Considering that the recorder will cost you about £32 on its own that extra expense ought not to be necessary just to be able to plug it into the mains

Still after nipping up an old Oric PSU we got the recorder working and it SAVEd and LOADed all sorts of things without any problems and it s quite well designed so it wasn t at all fiddly to use My only criticism is that the need to buy batteries and or a power supply makes it more expensive than it really needs to be

If you re interested try contacting Philips Consumer Advice 420 London Road Croydon CR9 3OR (01 689 2166)

Cliff Joseph

Quicksoft

Desert Burner
Creative Sparks
£2.50

As leader of a small band of freedom fighters your task is to deliver the plans of a new weapon to another underground group. You means of transport is a powerful motorcycle called Desert Burner which is capable of over 200 mph.

By itself this is a pretty simple task but what the instructions do not tell you is that you have to emulate Evil Knievel in jumping over various obstacles whilst avoiding bombs dropped by helicopters. You can attack the helicopters by firing at them via the space key. Controls are simple: Caps Shift to accelerate and Z to jump.

As with many games of this simplicity it has an addictiveness out of proportion to the action. It may not be particularly sophisticated – a few flickers, a few attribute clashes, but it is pretty good value for the money. A nice touch is the slowly sinking sun and the moon appearing at night. A high score is kept but no hall of fame.

GRAPHICS	* * * *
ADDICTIVENESS	* * *
OVERALL	* * * *

Supersam
Budgie Software
£2.50

An unusual plot here. The object is to explore the 34 rooms of a fortress and collect the 18 parts of a cage in which to catch the elusive Boris. This is complicated by misleading doorways which send you astray and potholes which are fatal. Added to this you have an energy level which drops on contact with one of the wandering baddies – when completely depleted you lose one of your three lives. On the positive side are syringes which make you invulnerable for a brief period.

Options for joystick or redefine keys are included and it features one of the most interesting loading systems I've yet seen. Again, this game has a charm of its own and I happily played away on it. The graphics are fairly good although slight flickering and attribute clashes are evident. The screens are well designed and provide a good challenge. Though essentially a maze dodge and collect game it is reasonable value for money and will provide a few hours of amusement.

GRAPHICS	* * *
ADDICTIVENESS	* * *
OVERALL	* * *

Nonterraqueous
Mastertronic
£1.99

This game is one which puts some full priced offerings to shame. With over 1000 screens of well designed problems to negotiate, fast action, smooth well animated sprites and a set of problems to solve, this game is a must for any arcade addict.

Put simply it is a variation on the maze search and dodge theme, but objects have not merely to be collected but also used to enable you to get further into the game. The ultimate objective is to explore the inside of a giant mountain to find and then destroy the computer which controls the population of your planet. Options for various joystick interfaces are provided and keys QAOP give up/down/left/right movement. Space fires and I and U allow specific actions. The game is very addictive and the inclusion of a high score chart encourages you to keep trying to improve.

Would I buy it? Yes!

GRAPHICS	* * * * *
ADDICTIVENESS	* * * *
OVERALL	* * * * *

Cylu
Firebird
£2.50

Well you can't avoid comparisons and this one just asks to be likened to Knight Lore. Your quest is to search the maze (yes yet another maze) find, collect and return to the master computer 24 objects. To achieve this you will have to solve the problem of how to disable 32 fuse fields, pick up the right objects, terminals and use the master refuel and master return to base units.

This is a game to get your fingers in a twist as there are no fewer than 11 control options plus save/load/abort game options. Movement, graphics and screen designs are very good but the game is hard to get into, the problem of running out of fuel caused many a promising game to end rather too soon.

This is one for the expert gamester and should give many hours of enjoyment, however I must admit in the time I had to review it I did not get too far – once the pressure of writing this is off I will be going back for another session.

GRAPHICS	* * * *
ADDICTIVENESS	* * *
OVERALL	* * * *

Chinese Patience
Atlantis
£1.99

I remember Atlantis card game program *Eights* which I still play on occasion and so was pleased to receive this program. Chinese Patience is another card game and matches you against the computer and boy does the machine play a mean game!

The instructions take up the whole of the inside of the insert plus the flap, reading them makes the game seem very complicated. However once I ran through the game a couple of times I got the hang of it and found it frustratingly absorbing.

The graphics are well designed and the screen layout is clear and uncluttered, the program is well error trapped – try pressing break! There is a fairly lengthy wait while the computer makes its moves but not so long that you get bored. I found I took much longer than the computer to decide on my moves.

If you have the patience and like card games (and even if you don't I suggest you try this one) then this will keep your mind ticking over for many a long winter's night. Unusual in this day and age is the loading system using LOAD "" CODE. It is a bit amateurish but this is only my criticism.

GRAPHICS	* * * *
ADDICTIVENESS	* * * *
OVERALL	* * * *

Action Biker
Mastertronic
£1.99

In conjunction with a well known snack manufacturer the character of Clumsy Colin is brought to the computer screen. Using a split graphics and text window you have to ride around town, find Mary and take him to the Spaceport. Control is UP/DOWN/LEFT/RIGHT by keys AZNM plus space to enter a house.

Graphics are OK, movement and animation is fair and the action fast and furious. High scores are kept but no hall of fame. This is a fairly average game which gave me a few interesting moments but no real desire to go back to it again. I know how game players vary in what they like and many of you will enjoy this game so I would simply suggest you try it out at your local computer store and make up your own mind. It didn't do a lot for me.

GRAPHICS	* * *
ADDICTIVENESS	* *
OVERALL	* * *

Speakeasy

Kai Webber has come up with a machine code routine that turns the Spectrum into a speech synthesiser.

This is by no means the first Spectrum speech program but it does offer far greater man pula tion of speech data than some of the other efforts that have ap peared in magazines allow ng crackles and noise to be cut down greatly Basically what this program allows you to do is to record speech from a tape recorder (along with a few extra noises thrown in for good measure!) and then replay this speach in your own programs

Begin by carefully typing in the BASIC listing and then save it to tape with SAVE "SPEAKWELL" LINE 1 When you run the program you should be confrontad with some data details at the bottom of the screen which are fairly self ex planatory and a menu of op tions

R — RECORD SPEECH

This allows you to record your voice into the computer s memory at the current record play speed When you select this option you will be told to press any key to start recor ding There are two methods you can use to record speech (experiment with both methods to see which gives best results)

1) Record your voice onto a tape and play this tape into the com puter pressing a key just before the speech starts (Try different volume settings until you achieve the best results)

2) Set the recorder into Record mode (remove any tapes in the recorder find the small switch in it which checks to see if a tape has a write protect tab press this in and press PLAY and RECORD on the recorder at the same time) press a key and start talk ng into the tape recorder s microphone

P — PLAY BACK SPEECH

This w ll simply replay any speech stored in memory at the current record/play speed

A — ALTER START ADDR

This allows you to alter the start address from which speech is recorded/played back If there is a lot of noise from the tape recorder at the start of some speech you can get rid of it by altering the start address by trial and error (If the start ad dress plus the length of data would cause the data to overflow into the graphics area of the computer will prevent you from using this value — lower the length first — see below It will also reject any value below 32855)

L — CHANGE LENGTH

Allows you to change the length of speech to be recorded/played back The com puter will prevent you from us ing any value which w ll cause an overflow into the graphics area

S — CHANGE SPEED

Lets you change the record/play back speed By play ing back at a different speed you can alter the pitch of your voice The slower the speed the worse speech will sound (Values below about 2.5 are of little use)

M — MEMORY MANAGER

A useful tool that allows you to move blocks of speech around in memory Three parameters are required ad dress to copy from address to copy to and number of bytes to copy If invalid address ap pears on the screen then you have tried to overwrite either the graph cs area of the machine code If you wish to remove noise that was recorded before you started speaking find the start address of the actual speech (using S) and enter this as the address to copy from Enter the address to copy to and the number of bytes to copy and then alter the start address to the value you used as the ad dress to copy to (Got that?!)

T — TAPE OPERATIONS

This prints up a self explanatory tape menu For those of you who are interested I have included an assembly language listing of the machine code

You may find that if you use an expensive tape recorder you will get better results than a cheap portable recorder but do not do anything silly like feeding the output of a power amp st ght into the back of your Spectrum! It also helps if you stress the words as you speak into the tape recorder

```
  10 BORDER 0: PAPER 0: INK 7: C
LEAR 32767: RESTORE 9920: GO SUB
 9850
  20 LET SPEED=1: LET START=3285
5: LET LENGTH=32512
  30 GO SUB 9730
  40 RESTORE 9720: LET K$=INKEY$
  50 FOR F=1 TO 7
  60 READ A$,LINE: IF A$=K$ THEN
  GO SUB LINE: GO SUB 9810
  70 NEXT F
  80 GO TO 40
9230 PRINT AT 17,0; FLASH 1;"L -
 LOAD   S - SAVE   R - RETURN":
PAUSE 1: PAUSE 0: PRINT AT 17,0,
,
9240 IF INKEY$="l" THEN  GO TO 9
280
9250 IF INKEY$="s" THEN  GO TO 9
320
9260 IF INKEY$="r" THEN  PAUSE 1
: RETURN
9270 GO TO 9230
9280 INPUT "NAME OF FILE?  ";N$
9290 IF LEN N$>10 THEN  PRINT AT
 17,7; FLASH 1;"INVALID FILE NAM
E": GO TO 9280
9300 PRINT AT 17,0,,AT 17,11; FL
ASH 1;"LOADING...": LOAD N$CODE
9310 RETURN
9320 INPUT "NAME OF FILE?  ";N$
9330 IF LEN N$>10 OR N$="" THEN
 PRINT AT 17,10; FLASH 1;"INVALI
D NAME": GO TO 9320
9340 PRINT AT 17,0,,: SAVE N$COD
E START,LENGTH
```

```
9350 PRINT AT 17,10; FLASH 1;"VE
RIFY (y/n)": PAUSE 0: GO SUB 981
0: IF INKEY$="n" THEN  RETURN
9360 PRINT AT 17,10; FLASH 1;"VE
RIFYING..": VERIFY N*CODE
9370 RETURN
9380 INPUT "ADDRESS TO COPY FRON
?  ";HL
9385 PRINT AT 17,0,,
9390 IF HL<32855 OR HL>65366 THE
N  PRINT AT 17,6; FLASH 1;"INVAL
ID COPY ADDRESS": GO TO 9380
9400 INPUT "ADDRESS TO  COPY TO?
  ";DE
9405 PRINT AT 17,0,,
9410 IF DE<32855 OR DE>65366 THE
N  PRINT AT 17,2; FLASH 1;"INVAL
ID DESTINATION ADDRESS": GO TO 9
400
9420 INPUT "NUMBER OF BYTES TO C
OPY?  ";BC
9430 IF BC+DE>65367 OR BC+HL>653
67 THEN  PRINT AT 17,9; FLASH 1;
"INVALID NUMBER": GO TO 9420
9440 POKE 65521,DE-256*INT (DE/2
56): POKE 65522,INT (DE/256)
9450 POKE 65524,BC-256*INT (BC/2
56): POKE 65525,INT (BC/256)
9460 POKE 65527,HL-256*INT (HL/2
56): POKE 65528,INT (HL/256)
9480 IF BC=0 THEN  RETURN
9490 RANDOMIZE USR 65528
9500 RETURN
9510 INPUT "NEW SPEED?  ";SPEED
9520 IF SPEED<0 OR SPEED>255 THE
N  PRINT AT 17,9; FLASH 1;"INVAL
ID SPEED": GO TO 9510
9540 POKE 32854,SPEED
9550 RETURN
9560 INPUT "NEW LENGTH?  ";LENGT
H
9570 IF LENGTH<1 OR LENGTH+START
>65367 THEN  PRINT AT 17,9; FLAS
H 1;"INVALID LENGTH": GO TO 9560
9590 POKE 32852,LENGTH-256*INT (
LENGTH/256): POKE 32853,INT (LEN
GTH/256)
9600 RETURN
9610 INPUT "NEW START ADDRESS?
";START
9620 IF START<32855 OR START>653
60 OR START+LENGTH>65367 THEN  P
RINT AT 17,8; FLASH 1;"INVALID A
DDRESS": GO TO 9610
9640 POKE 32850,START-256*INT (S
TART/256): POKE 32851,INT (START
/256)
9650 RETURN
9660 RANDOMIZE USR 32800
9670 RETURN
9680 PRINT AT 17,9; FLASH 1;"PRE
SS ANY KEY TO START RECORDING":
PAUSE 1: PAUSE 0: PRINT AT 17,0,
,AT 17,11; FLASH 1;"RECORDING"
9690 OUT 254,15: RANDOMIZE USR 3
2768
9700 BEEP 1,5
9710 RETURN
9720 DATA "r",9680,"p",9660,"a",
9610,"l",9560,"s",9510,"m",9380,
"t",9230
9730 PRINT TAB 11;"SPEAKWELL"
9740 PRINT TAB 11;"---------"
9750 PRINT 'TAB 6;"R - RECORD SP
EECH"
9760 PRINT 'TAB 6;"P - PLAY BACK
 SPEECH"
9770 PRINT 'TAB 6;"A - ALTER STA
RT ADDR"
9780 PRINT 'TAB 6;"L - CHANGE LE
NOTH"
9790 PRINT 'TAB 6;"S - CHANGE SP
EED"
9800 PRINT 'TAB 6;"M - MEMORY MA
NAGER"'TAB 6;"T - TAPE OPERATIO
NS"
9810 PRINT AT 19,0;"START ADDR O
F SPEECH DATA:";START
9820 PRINT "END ADDRESS OF SPEEC
H DATA:";START+LENGTH
9830 PRINT "LENGTH OF SPEECH DAT
A:";LENGTH;"    ";#1;AT 0,0;"REC
ORD/PLAY SPEED:";SPEED;"    "
9840 PRINT AT 17,0,,: RETURN
9850 FOR F=32768 TO 32854
9860 READ A: POKE F,A
9870 NEXT F
9890 FOR F=65520 TO 65531
9900 READ A: POKE F,A
9910 NEXT F: RETURN
9920 DATA 243,42,82,128,237,91,8
4,128,6,8,14,0,237
9930 DATA 67,0,0,175,219,254,23,
23,203,17,16,247,113,58
9940 DATA 86,128,71,16,254,35,12
2,179,27,32,226,251,201,243,42
9950 DATA 82,128,237,91,84,128,6
,8,78,203,9,203,9,203,9
9960 DATA 121,230,16,211,254,203
,1,16,247,58,86,128,71,16,254
9970 DATA 203,135,35,122,179,27,
32,224,251,201,87,128,0,127,1
9980 REM BLOCK MOVE MACHINE CODE
9990 DATA 17,0,0,1,0,0,33,0,0,23
7,176,201
```

ASSEMBLY LISTING

```
10    ;        RECORD MODE
20             ORG  32768
30             DI                      ;DISABLE MASKABLE INTERRUPT
40             LD   HL,(START)         ;START ADDRESS OF DATA INTO HL
50             LD   DE,(LENGTH)        ;DATA LENGTH INTO DE
60    LOOP     LD   B,8                ;B CONTROLS LOOP OF 8 BITS/1 BYTE
70             LD   C,0                ;C COUNTS NO. OF BITS AT EAR PORT
80             LD   (0),BC             ;TIME WASTING INSTRUCTION
90    LOOP_2   XOR  A                  ;CLEAR A AND CARRY FLAG
100            IN   A,(254)            ;READ PORT 254
110            RLA                     ;VALUE AT EAR PORT. .
120            RLA                     ;ROTATED.
130            RL   C                  ;INTO REGISTER C
140            DJNZ LOOP_2             ;GET 8 BITS FROM EAR PORT INTO C
150            LD   (HL),C             ;STORE THE 8 BITS IN (HL)
160            LD   A,(SPEED)          ;RECORD/PLAY SPEED INTO A
170            LD   B,A                ;USE B TO CONTROL THE LOOP
180    WAIT     DJNZ WAIT               ;WAIT A SHORT WHILE
190            INC  HL                 ;NEXT LOCATION FOR NEXT 8 BITS
200            LD   A,D                ;CHECK WHETHER OR NOT. .
210            OR   E                  ;TO FETCH ANOTHER 8 BITS
220            DEC  DE                 ;DECREMENT THE COUNT
230            JR   NZ,LOOP            ;LOOP IF COUNT NOT ZERO
240            EI                      ;RE-ENABLE THE MASKABLE INTERRUPT .
250            RET                     ;FOR RETURN TO BASIC
260
270
280   ;        PLAYBACK
290            DI
300            LD   HL,(START)
310            LD   DE,(LENGTH)
320    P_LOOP   LD   B,8                ;B CONTROLS LOOP OF 8 BITS/1 BYTE
330            LD   C,(HL)             ;GET DATA BYTE TO BE PLAYED
340            RRC  C                  ;GET THE BITS IN THE RIGHT ORDER
350            RRC  C
360            RRC  C
370    P_LP_2   LD   A,C                ;GET THE DATA BYTE INTO A
380            AND  %00010000          ;MASK THE ONLY REQUIRED BIT
390            OUT  (254),A            ;OUTPUT THIS BIT TO THE SPEAKER
400            RLC  C                  ;GET NEXT BIT INTO REQUIRED POSITION
410            DJNZ P_LP_2             ;OUTPUT 8 BITS (1 BYTE)
420            LD   A,(SPEED)          ;SPEED INTO A
430            LD   B,A                ;TRANSFER TO B FOR PAUSE
440    PAUSE    DJNZ PAUSE              ;WAIT A SHORT WHILE
450            RES  0,A                ;ANOTHER TIME WASTING INSTRUCTION
460            INC  HL                 ;INCREMENT DATA ADDRESS
470            LD   A,D                ;CHECK TO SEE IF COUNT IS ZERO YET
480            OR   E
490            DEC  DE                 ;DECREASE THE COUNT BY 1
500            JR   NZ,P_LOOP          ;LOOP IF COUNT NOT ZERO
510            EI                      ;RE-ENABLE MASKABLE INTERRUPT..
520            RET                     ;FOR RETURN TO BASIC
530    START    DEFW 32855              ;START ADDRESS OF SPEECH DATA
540    LENGTH   DEFW 32512              ;LENGTH OF SPEECH DATA
550    SPEED    DEFB 1                  ;RECORD/PLAY SPEED
```

Mindplay

This month's Mindplay features three adventure games from the new generation of mass produced adventures written with the aid of Gilsoft's *Quill*, and released by small software companies — Fridaysoft and Sentient. While the Quill is a very useful utility for use by people who wish to write their own adventure I feel that the use of the Quill by software houses may have adverse effects on the adventure game genre. With the Quill it is a lot easier to produce *bad* adventure games as the thought and planning needed for a non Quilled game is often not applied. Thankfully there are exceptions and these exceptions are often very good games but the vast majority of Quilled games which are marketed are often average and sometimes very poor. The games reviewed this issue feature a couple of these exceptions.

You may have noticed a couple of letters in past issues of *ZX Computing* requesting hints and tips for adventure games. Well in response to popular demand I plan to introduce clues to adventures in this column. The idea is that you send your adventure problems and they'll be printed in Mindplay and anyone who can help then responds with the answer. Offers of help on adventures will also be printed. In this way adventurers can get in touch with each other through offering or needing help. I'd also be interested in your letters on the general adventure scene. Send all correspondence to Mindplay at the *ZX Computing* address: 1 Golden Square, London W1R 3AB.

Now on with the reviews.

Brian Robb

London Adventure
Fridaysoft
£4.95

The first of this selection of Quilled games is Fridaysoft's *London Adventure* and it is the best of the three adventures reviewed here. It's also the only one to feature a loading screen a nicely drawn picture of London's Tower Bridge.

The aim of the game is to find the combination of a safe deposit box belonging to your eccentric rich uncle. He has recently died and his will has left his considerably fortune to you — if you can find it, that is! The combination numbers are hidden within the adventure — for instance you may find a five pound note so five is one of the combination numbers. The numbers are cleverly hidden within the game often in the oddest of places!

London Adventure is designed to be realistic (allowing some artistic licence of course) logical and apart from the odd diversion and obligatory mazes geographically correct. The game features over 100 locations including many well known landmarks such as Harrods, Cleopatra's Needle and the Tower of London.

The location descriptions are very good in places such as aboard the Cutty Sark near the beginning while the majority of the descriptions are above average. Some of the locations though appear to be there only for show but at many of them you can find objects and clues. On this point it is wise to collect every object no matter how unlikely as it will no doubt be useful at some point.

The game has quite a few original and amusing touches which raise the adventure above the mass of Quilled games. London Zoo, for example, becomes a particularly clever maze as do the London Sewers. Another nice touch are the events in the Tower of London — you could lose your head over the Crown Jewels! Also typing your name on the computer in the Science Museum can be alarming!

Overall *London Adventure* is a very enjoyable and challenging game which makes a change from the usual fantasy settings and this is Fridaysoft's avowed intention. You could certainly do worse than buy this one!

Scoop
Sentient Software
£2.99

This adventure, like the previous one, is unusual in its setting and aim. You are an intrepid newspaper reporter and must search the streets for the front page news which will distinguish you from the other hacks. Fail in your task and you'll be fired!

The game begins with the piercing sound of your morning alarm. Sound features quite often in the game with the sounds of lifts and car engines, not forgetting the telephone which rings providing you with a message which moves you forward in the game. You awake right at the start to be faced by a morning domestic routine which becomes your first major task — you must get dressed and head off to work. This is a lot more complicated and confusing than you may think — even the simplest tasks are difficult to achieve first time round. Everything must be done in a particular order.

When you eventually find the newspaper office (and this could take a while) the newspaper boss will give you a story to investigate and from there you're on your own! Do you have the intuition which will take you to the top of your profession?

This is a very interesting adventure with fairly good location descriptions and often involved tasks which are difficult to complete. Like *London Adventure* *Scoop* is a very good example of a Quilled game at its best.

The Amulet
Sentient Software
£2.99

This one also comes from Sentient Software but unfortunately it does not aspire to the novelty of the previous game. Whereas *Scoop* was an inspired and novel game, *The Amulet* repeats the tired and worn fantasy theme of the quest.

The simple aim is to find the seven shards of the shattered Amulet which are scattered through time. Trying to retrieve the segments entails travelling through time and space using the magical power of the Amulet. You start out with a section of the broken Amulet which when rubbed enables you to travel in time in search of the other pieces. Each Time Zone consists of several very similar locations all with very bland location descriptions. Objects are sparse so it is easy to find each section of the amulet with very few major obstacles to be overcome.

Some of the locations insist on playing lengthy tunes after each input which are simply irritating and slow down play, particularly the zone featuring the Frenchman (who insists on killing you if you're not careful).

The Amulet is a rather clichéd and nondescript adventure with lacklustre location descriptions devoid of atmosphere and lacking colour.

London Adventure Fridaysoft Unit F The Maltings Station Rd Sawbridgeworth Herts

Scoop and The Amulet Sentient Software, Branch House 18 Branch Rd Armley Leeds LS12 3AQ

We, the jury . . .

Daley Thompson's Supertest
Ocean
£6.95

The very title of this one is enough to send the most robust of joysticks on strike and make the keyboard tremble in fear — Yep its another left/right as fast as you can test of finger pr wnst stamina!

I must admit that I did not like this type of game at first but then t grew on me until now I am hooked The success of a game of this nature depends on the quality and realism of the graphics no one is going to work up a sweat over moving an indistinct blob around so how have Ocean done? Well I'm sure owners of DT s Decathlon would have no doubts the graphics are just as good if not better than before and Ocean should have another well deserved hit on their hands

Even though all the games have only left/right and sometimes fire as controls there is enough variation and judgement required to prevent them from becoming tedious A brief run down and description of the events on side one is

PISTOL SHOOTING move cursor around the screen to random target and fire at centre
CYCLING L/R as fast as possible
SPRING BOARD DIVING 3 bounces and L/R for somersaults
GIANT SLALOM, steer L/R through the flags as they scroll up the screen toward you
ROWING L/R as fast as you can
PENALTIES L/R for speed line up on football fire to shoot
SKI JUMP L/R for speed fire to jump and land
TUG O WAR L/R for power

Each one needs slightly different techniques to succeed and I personally enjoyed the shooting and ski jump whilst the tug O war and diving gave me a lot of frustration

GRAPHICS * * * * *
ADDICTIVENESS * * * *
OVERALL * * * * *

Fighting Warrior
Melbourne House
£7.95

There has been a spate of fighting programs lately not the least being MH s WAY OF THE EXPLODING FIST but now they have combined the pure combat game with the adventure quest type to produce this game

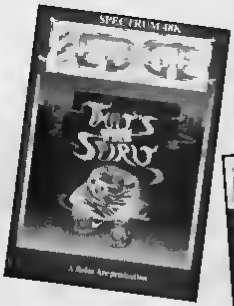
In Fighting Warrior your task is to rescue the princess from a selection of vicious enemies — must be a combination of thick and gluey and brutal

Joking at the expense of the spelling in MH s press release aside there is nothing gluey about the beautifully drawn and animated characters in this program they all act and react very quickly indeed Your character has to walk along as the background scrolls behind him and every few feet it seems encounters another adversary Fighting is done by sword and by using the four direction and the fire button joystick or keyboard you can back off move forward jump duck or strike at the upper mid or lower regions of your opponent Each of you has a graphic representation of your strength and stamina once it is all gone — RIP

Added to this there are objects which you have to puzzle out how to use and a frequent arrow attack which you must duck under or jump over even in the middle of an encounter

I found that the response was a little slow and it takes some getting used to before accurate timing of blows and dodges can be made It is also a very difficult game to play as you are under almost constant attack from the very start Even though I d d not get very far into the gameplay, the superb graphics and adventure style concept ensure that I will go back to th s one time and again Melbourne House yet again bring a touch of class to computer gaming

GRAPHICS * * * * *
ADDICTIVENESS * * * * *
OVERALL * * * * *



That's The Spirit
The Edge
£7.95

Hello I thought a clone of Ghostbusters? But no although the theme of ghostly beings is the same in reality there is really no similarity The game comes complete with the Edge s usual type of unhelpful and mildly humorous instructions on the reverse of which is an overlay for the old type Spectrums which shows which keys perform which operations

There are 28 actions wh ch you can perform and most of these are fairly clear Take Drop Enter etc but how and when to use them are left for you to discover It is with games like these that I wish the company would send us poor reviewers a hint sheet. I tried and I tried but no matter what I did I only succeeded in being driven insane — the game s end condition — in a few moves

The screen is a well presented two dimensional representation of New York and your character moves around meeting with various problems and objects of which the greatest are the ghosts Not state of the art graphics but very good nonetheless An mation is smooth although a little on the slow side and there are some nice touches of humour (try the swear key)

This is a game for the cerebral arcade player and as such is quite difficult personally I found t a trifle too difficult to get into and so do not feel particularly inspired to play it again

GRAPHICS	* * *
ADDICTIVENESS	* *
OVERALL	* * *

Monty On The Run
Gremlin Graphics
£8.95

Another in the Monty Mole series In this game he has to escape by travelling through many devious and delightful screens of pure frustration It seems too simple to describe it as another platform game but it is Added to the usual problem of carefully timed jumps is the sneaky device of having to choose and take withyou five items of equipment from a selection of 21 objects before you begin an attempt Get one wrong and you find yourself stuck and unable to get any further

The screens are well designed to provide just the right level of difficulty the animation is good — I loved Monty s somersaulting jumps — and key response is very good

My only moan is that collision detection seems to be by attributes and this often gives the impression that you have avoided some malignant sprite only to find Monty expiring in front of you With 43 screens this should keep his fans happy and probably gain him a few new ones One of the better programs of this type

GRAPHICS	* * * *
ADDICTIVENESS	* * * * *
OVERALL	* * * *

Bounty Bob Strikes Back
US Gold
£7.95

I m afraid we only got a review copy of this game and the aim and action was not clearly stated although they claim t compares favourably with the C64 version

It is a platform game in which it appears that you have to collect various objects within a time limit each time you get an object the nasties change from yellow to green for a short time and can be eaten/killed by your character

Loads of screens most of which are well designed and present a challenge some have a nice 3 D perspective effect

I must admit I found the game to be a little inconsistent in that I could clear some screens with ease and others were a real headache they did not seem to progress logically Graphics and animation were very good BB s demise is quite interesting and the high score hall of fame routine is almost worth playing on its own

Colourful enjoyable I just wish I knew what I was supposed to be doing

GRAPHICS	* * * *
ADDICTIVENESS	* * *
OVERALL	* * *

Macadam Bumper
PSS
£6.95

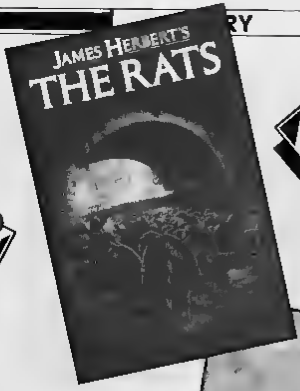
It is hard to simulate the old pin table bumpers buzzers, bleepers nudges and all the paraphernalia of the arcade on a home computer I love p nball tables and have awaited a good computer vers on for some time

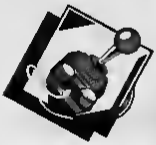
This one is as close as I think it is possible to get all the usual features are implemented and you can almost feel the balls bouncing around giving them just that gentle nudge at the right time Not only is the standard program very playable but there is also the option to design your own pinball table layout and play it This is a simple matter although to get the best results a little planning is required at first The screen is split into two vertically and the playing area is on the left while a typical pinball picture is on the right This also shows scores and players turns etc In design mode this picture is replaced by the graphic components of the table and they are selected and placed on the playing area as required

Once designed and completed you can save your work to tape you can even send it to PSS as an entry to their competition and win your very own real pinball machine Not bad As a pinball program it is very playable and with the option of making your own designs the life of this program is extended greatly Get bored design a new game

I must admit I enjoyed the fact that I didn t keep losing a game when an overenthusiastic nudge would usually produce a tilt message this feature does not seem to have been included However I keep getting the annoying feeling that I ve cheated in some way

GRAPHICS	* * * *
ADDICTIVENESS	* * * * *
OVERALL	* * * * ▶





The Rats
Hodder and Stoughton
£7.95

An interesting program which combines strategy and adventure by the use of multiple choice input. The game is based on the James Herbert novel and it does help if you have read this book, however it is not essential and the game can be enjoyed on its own merits.

Your prime task is to deploy your forces around London to contain and defeat the rats. this is done by moving a cursor around a map of the city and viewing appropriate sections. Once a section has been chosen information on the number of men and their equipment is displayed. You can then modify this.

Every now and then the game changes into adventure mode where one of your characters, either one of the main four or one of the many supporting characters, is faced with a meeting with the revolting rodents. In this mode the text input is built up word by word from a bank of options.

Graphics are used to good effect when you make a fatal mistake the rat leaps through the text. The whole thing is quite an unusual concept and I enjoyed it greatly, however the vivid descriptions are quite gory and not for the squeamish. It will take quite a bit of playing to master this game, especially as the secondary characters load in a random fashion making plenty of game play variation.

This latter feature is not clearly explained and caused a couple of aborted loadings as I thought the program had crashed. If a block is not loading then leave it, it is probably simply not required for that variation of the game.

GRAPHICS ★★★★
ADDICTIVENESS ★★★★
OVERALL ★★★★★

Marsport
Gargoyle Games
£9.95

Gargoyle Games have now forsaken Celtic mythology and ventured into space for their latest game. However Marsport does retain the style of the earlier Tir Na Nog and Dun Darch in that the game puts you in control of a large animated figure (named John Marsh) who moves around a large playing area has to solve various puzzles and deal with many creatures in order to complete his task.

In this instance that task is to save the Earth from conquest by an alien race. You must control John Marsh as he finds his way through a large and complex space station in order to reach a force field generator that will help to defend the Earth.

The basic style of animation is much the same as Gargoyle's earlier games but this time the movement of the main character is even smoother than before. The background graphics — depicting the corridors, lifts, and various entrances in the space station — are more complicated than those of Darach/Nog and scroll slightly less smoothly as a result but even so the overall effect is excellent.

The mechanics of the game have also been enhanced and Marsport is more complex than its predecessors in some ways because you now have a greater ability to manipulate objects and engage in combat than before although trading this off against the memory available has meant that there seem to be fewer independent characters to deal with. Mind you that's not a criticism as I think I prefer the slightly greater emphasis that this puts on the action elements of the game. Dun Darach was an extremely engrossing game but couldn't equal the surprise that Marsport will give you when you walk straight into the head baddy.

Marsport is the first in a planned trilogy of games and if this game is anything to go by I'll be looking forward to the rest of the trilogy.

GRAPHICS ★★★★★
ADDICTIVENESS ★★★★★
OVERALL ★★★★★

Astroclone
Hewson Consultants
£7.95

The Seldabb are back! Hewson Consultants have resurrected their old archnasties for their latest game but this time around the author Steve Turner has used the same sort of programming techniques that worked so well in his two Avalon games.

Astroclone has a number of similarities to Marsport in that Hewson have taken a formula that worked well in mythological settings and turned it to a science fiction setting. Taking the part of a crack Astroclone warrior you must gain control of the Seldabb bases in order to deactivate the Stargates that they used to reach Earth.

The graphic layout of the game is of course similar to that of the Avalon games but this time you have more than one stage to the game. You can either move around the bases (or Technibo as they are called) in search of the Gravitron devices you will need or you can take off in your fighter and head off to combat the Seldabb cruisers. These two parts of the game provide a nice balance: the action in the bases is of the problem solving arcade adventure style whilst the space combat is a fun piece of shoot 'em up action.

Astroclone is quite complex (the reviewers notes that Hewsons sent out with the game make quite a fat folder) and though I enjoyed it I'm not sure if it will appeal to everyone. Like Avalon and Dragontorc the problem solving can slow the game down quite a lot in places and despite the combat sequences the game may not appeal to the shoot 'em up brigades.

GRAPHICS ★★★★
ADDICTIVENESS ★★★★
OVERALL ★★★★

Sparkler's Special Creative Sparks £7.95

Creative Sparks have joined the compilation brigade and lumped together four of their old titles as a sort of software Christmas stocking.

The four titles, which are held in a two cassette package, are Orc Attack, Stage Coach, River Rescue and Tower of Evil. They're all quite old titles, and none of them were really state of the art even when they were new. Orc Attack is probably the most addictive of the games, in which you control a little knight who is at the top of a castle wall and being besieged by hordes of Orcs. The Orcs have got little ladders with which they attempt to scale the walls, and you must fend them off with rocks, sword and burning oil. The screens aren't very varied, but it is one of those simple games that can become quite frantic as the skill levels get harder.

Tower of Evil was a forerunner to Atic Atac in which you have to guide your character through the rooms of a tower collecting treasure and keys to other rooms. It's mildly enjoyable, but unsophisticated compared to more recent games.

Stage Coach seems to be unplayable, since try as I might, I couldn't get my cowboy figure to jump successfully from his horse onto the stage coach in order to try and collect the passengers dotted along the route.

River Rescue is a very simple game which allows you to guide a speedboat along a river as you attempt to collect passengers and avoid the alligators and logs bobbing about in the water. The scrolling river doesn't have much variation in detail, and it gets to be a bit of a strain on the eyes after a while.

All in all, though I'm not particularly impressed with any of the games, they do seem the sort of thing that might appeal to younger children who aren't yet up to games as complex as Marsport, so the Sparklers' Special might make a reasonable present for youngsters around the age of ten.

GRAPHICS	* * *
ADDICTIVENESS	* *
OVERALL	* * *

The Secret Diary of Adrian Mole Mosaic £9.95

This is a bit of a disappointment I'm afraid, despite being programmed by Level 9. The trouble is that there's not really much of a game here. The program boasts some 200 K of text but most of it seems to have been lifted straight out of the Adrian Mole diaries and is presented onscreen just as if you were reading the books themselves. There is very little opportunity to become actively involved in the game and as far as I can tell, nothing of the sort of problem solving that is the essence of most adventures.

User participation takes the form of making decisions for Adrian in his attempts to become as popular as he can. The trouble is that this decision making process is very limited: you are presented with three options (along the lines of: Shall I read this poem to Nigel/Pandora /the teacher?) and you simply press keys 1 3 as appropriate. There is no opportunity for any independent actions or direct text entry, and you can only sit there reading great chunks of text while you wait for the program to ask you to press a button.

Admittedly, the text is very amusing in places, but if all you want is to read the diaries then why not go out and buy the books? Buying both the Adrian Mole books would still cost less than this program, they won't give you a stiff neck from staring at the computer screen and they're funnier as well.

GRAPHICS	* * *
ADDICTIVENESS	* *
OVERALL	* *

Hacker Activision £7.99

How do you review a game like this without spoiling it for any potential buyers? The whole point about Hacker is that it simulates the experience of breaking into a large corporation's mainframe and becoming involved in its operations. However, just as you would experience this in reality, there are no instructions to help you determine what is happening or what you are supposed to be doing. In other words, you stumble in blind.

Consequently, there's not much I can say about the game without giving it all away. This isn't a game where you simply have a task to solve — well, yes you do actually, but first of all you have to figure out what that task is. What I can say about Hacker is that it will take you all over the world and involves a search for various pieces of information.

Hacker begins with a simple blue screen, blank except for the words: Log On Please, and from here on it's up to you. If you succeed in logging on you'll get into the mainframe and have a to sort out the information that is presented to you.

This is not a game that's likely to appeal to arcade addicts but for adventure fans and people who like to get their teeth in to a good infuriating puzzle it's probably the best thing to come along since Level 9 adventures.

GRAPHICS	* * *
ADDICTIVENESS	* * * *
OVERALL	* * * *

Halley's Comet Anima £8.95

With Halley's Comet just around the galactic corner there seem to be a number of comet related programs popping up at the moment. This one from Anima Scientific Computing actually consists of two programs: a Planetarium which gives a view of the sky and the progress of the comet during both night and day, and an Orrery which is a model of the solar system and the comet's path through it.

The Orrery initially gives a view of the sun and plots the orbits of the inner planets around it. Then using the cursor keys you can rotate this view allowing you to observe the solar system from any angle which creates quite a fascinating effect. You can also use the 'V' and 'Z' keys to enlarge or shrink the view to include the orbits of the outer planets as well.

The Planetarium is less interesting visually but perhaps more useful since by showing you the path of the comet in the sky it will allow you to trace the comet (and the other planets in the sky) when it does arrive. There are options here to take into account atmospheric effects and to see below the horizon, and, as with the Orrery, to rotate the view so that you are looking at the sky from different directions.

Both programs have options which allow you to manipulate the time scale — either to travel backwards and forwards in time to other appearances of the comet or to speed up/slow down the passage of the comet as shown on the screen.

Obviously an astronomy program like this will appeal only to a small specialist audience but it does seem to achieve its aims quite well. It's a little expensive but after all Halley's Comet only turns up every seventy years or so. If you're interested why not contact Anima at 33 Lilac Walk, Tyne and Wear NE31 2LT (0632 832825).

The Sound Of Music

John Ainslo presents Interface I owners with some new sound commands for controlling a Programmable Sound Generator.

The Spectrum is a poor relation when it comes to making music or even simple noises to enhance games as it only has a very simple single channel BEEP command and no noise generator though by machine code techniques it can be made to create noise

The Programmable Sound Generators (PSGs) AY 3-8910 and AY 3 8912 by contrast offer three tone channels and one noise generator which can be mixed with any of the three tone channels but these too suffer from one serious drawback in that programming of the PSG is long tedious and difficult as it requires a minimum of six OUT commands in basic to make even the simplest tone emanate from the loudspeaker

A variety of sounds which can be incorporated into games to improve them and make them more realistic can be produced by the PSG The sounds can range from a simple tone to complex mixtures of three channels with or without noise which are completely under software control The PSG also has the ability to continue making its sound while the microprocessor performs other tasks and unlike the Spectrum s bleeper can also generate chords

Fig 1 shows the block diagram of the 8912 which differs slightly from the 8910 in that it has one In/Out port where the 8910 has two There are three independent tone generators and a noise generator which can be mixed with a tone or tones or it can be output on its own The amplitude of tone channel can be set independently to any one of fifteen values The envelope generator amplitude modulates the outputs and can be set for fast or slow decay or attack repeat or single shot

These two devices were intended for use with CPU s which use a shared address and data bus but can be interfaced with the Spectrum quite easily Register selection and data transfers are both done via the data lines and the device is set up to receive either by the state of two control lines BDIR and BC1 All that is required is to select a register by setting both control lines high and then sending the data to that register with BDIR remaining high The decoding is greatly simplified on the Spectrum by using the IORQ signal together with the required PORT ADDRESS Thus OUT 221 X will prepare the PSG for data transfer to register X and OUT 223 Y will transfer data Y to that register The WR IORQ A6 and A1 are decoded to give BDIR and BC1 IN 221 can be used to read the contents of the last register pointed to by an OUT instruction

With the advent of Interface 1 this can all be changed as the user is no longer confined to using IN and OUT commands and complete control of the PSG can now be achieved in EXTENDED BASIC

This article outlines the two phases of the project Firstly the method of creating routines to enlarge the normal basic is described in detail as the principle can be used to create any command required Secondly a description with examples on how to use the newly created commands to try to maximise their usefulness

The New Commands

Three new commands have been created to allow the programming of the PSG which will be syntax checked on entry and run like the normal commands in that their use will be transparent to the user though the means of achieving this is entirely different The three new commands are

***SOUND**
***MUSIC**
***PLAY**

but there is no limit to the number of new commands that can be added by the same method

The new commands are machine code routines stored in RAM and the code once loaded can be initialised with one RAND USR call which will point the error vector to the new routine and programming can then begin

Extended Interpreter

When a BASIC line is entered the old ROM checks it for syntax errors If this test fails further checks are done by the Interface 1 ROM which now checks the line for Interface 1 commands such as MOVE which gave an error message in the unexpanded system but will now be accepted If these syntax checks also fail the processor jumps to the error handling routine at ERR 6 via the address vector created with the new system variables at 232735 and 23736 These addresses normally point to 01F0H but can be redirected to the new routines where further checks can be performed and then returned to 01F0h if required thus allowing the addition of new commands

The extended interpreter first checks the line for * followed by a letter It is necessary to use a symbol to stop the entry of a normal command word though they can be used as anything which fails the normal syntax checks can have further tests done For example PRINT * could be used as a new command with the extended interpreter checking for token 245 and then *

As there are only three commands each with a different initial letter only a simple test on the initial letter is being used If any of the checks fail then a syntax error is given otherwise control passes to the routine for that command The interpreter then checks the rest of the line

NOTES	2	4		7	9	11		2	4		7	9	11	
	C#	D#		F#	G#	A#		C#	D#		F#	G#	A#	
	C	D	E	F	G	A	B	C	D	E	F	G	A	B
NOTES	1	3	5	6	8	10	12	1	3	5	6	8	10	12
OCTAVE				0							1			

*MUSIC SCALE

for the required integers or variables and separators. If all is well then the routine will be exited and allow entry of the line in to the program. The syntax used for the command requires a space between the end of the command word and the first integer or variable, but the syntax checker will accept capital or small letters in the command word which allows any printout of the program to look like original Spectrum commands except that they are preceded by a *

Software Notes

When the SHADOW ROM is paged in routines in the BASIC ROM can be called up using RST 10H followed by the address of the routine required. In syntex time EXPT1 is used to process numeric expressions and STEND is called to mark the end of the statement. Progress is made down the line being checked by use of GETCH to find the * and NXTCH to advance past it. ERR6 points to the original address in the BASIC ROM which was intercepted to enable the new routine. CHADD is used to read the next character including spaces. During runtime EXPT1 puts the integers on the calculator stack from where they are retrieved by FINT1 and put into the Accumulator in the case of 8 bit integers and retrieved by FINT2 and put in the BC register pair in the case of 16 bit integers. This is a programming choice which has to be made depending on the size of the integers involved and is not done by the operating system. The runtime exit is made by a jump to END1

The New Commands

The commands may at first sight appear to duplicate each other but that is not the case and there is a specific purpose to each

*PLAY enables the required channels and defines the type of sound

*MUSIC will give a tone from the musical scale

*SOUND will give a tone or noise of a given pitch

***PLAY**

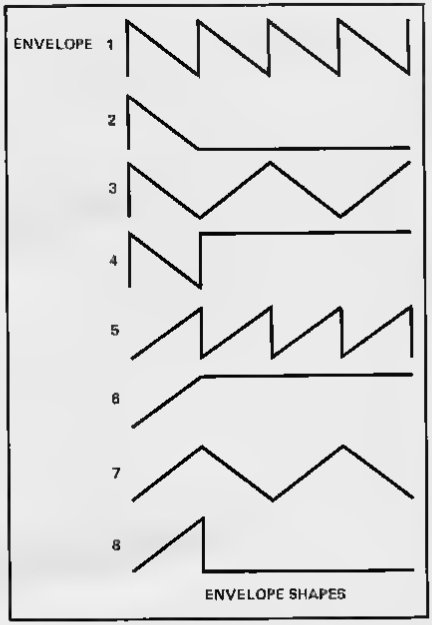
Format tone channel, noise channel, envelope shape, envelope period

tone channel 0-7
noise channel 0-7
envelope 0-7
duration 0-32767

This command does not actually produce any sounds but is used to enable the designated tone and noise channels selected by *MUSIC or *SOUND. It does, however, select the envelope shape and period which are common to all channels. There are three tone channels and three noise channels through which noise is output from the single noise generator. The effect of combining the channels is beyond a simple description and only experimentation can bring out the full capabilities of the generator. TONE CHANNEL selects either no channels at all or any combination of the three where the binary bits of the number indicate the channels required. The NOISE CHANNEL selection is done in a similar manner to the tone channel selection. The

ROUTINE	VALUE	FUNCTION
GETCH	0018h	Gets character from basic into A
NXTCH	0020h	Gets next character ignoring spaces
CHADD	0074h	Reads next character
ERR6	01F0h	Normal error handling address
STENO	05B7h	Syntax exit routine
END1	05C1h	Run time exit routine
EXPT1	1C82h	Syntax check for numerics — puts it on stack if alright
FINT1	1E94h	Puts single byte integer from stack in A
FINT2	1E99h	Puts two byte integer from shack in BC
STAKA	2D28h	Puts A on stack
STORE	58F0h	Eight byte temporary store

TABLE OF VARIABLE AND THEIR FUNCTIONS



ENVELOPE SHAPES

ENVELOPE shape is selected with reference to fig 2 and takes control of the output volume when the volume parameter on that channel is zero. If 2 or 8 is selected then an envelope of a fixed length is given. Any other choice will select a continuous sound but each has a different shape and will therefore give the sound a different timbre. The DURATION of the Envelope Period is a value between 0 > 65335

Although the PSG could never be classed as a synthesiser the ability to modify the output waveform does allow different sounds to be produced. A sharp attack or rise time produces a percussion type sound and if followed by a rapid decay will give a sound like a snare drum. As the attack and decay are lengthened a more mellow sound will be produced. For envelope type 2 a period of around 1000 will give a sharp banjo effect and using envelope 5 with a short period of around 20 will give a machine like effect

The duration of the note is no longer defined and will continue to sound until either the pitch is changed or it is turned off using *PLAY 0,0,0,0 which will reset all the registers to zero except register 7 which is set to 255

```
10 REM play demonstration
20 INPUT "envelope shape ";e
25 INPUT "duration ";d
30 *SOUND 1,200,0
40 *PLAY 1,0,e,d
50 PRINT AT 10,2 "Press any
key to re enter"
55 PAUSE 0
60 CLS
70 GOTO 10
```

***MUSIC**

Format channel, octave, note, volume

channel 1-3
octave 0-6
note 1-12
volume 0-15

This command is used to generate a musical output of a tone set by OCTAVE and NOTE and output it through the designated CHANNEL at the ▶

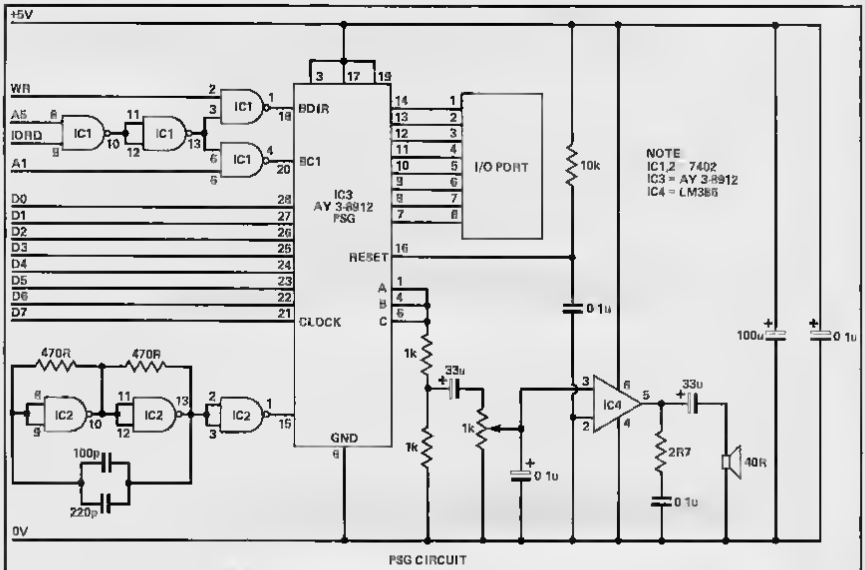


Figure 1 Diagram of the 8912 PSG C[illegible]

REGISTER	FUNCTION	BIT							
		7	6	5	4	3	2	1	0
R0	Channel A - Tone Period	8 Bit Fine Tone A							
R1		4 Bit Coarse Tone A							
R2	Channel B - Tone Period	8 Bit Fine Tone B							
R3		4 Bit Coarse Tone B							
R4	Channel C - Tone Period	8 Bit Fine Tone C							
R5		4 Bit Coarse Tone C							
R6	Noise Period	5 Bit Control							
R7	Channel Enable	I/O		Noise			Tone		
				L	B	A	C	B	A
R8	Channel A Amplitude	Env	4 Bit Control						
R9	Channel B Amplitude	Env	4 Bit Control						
R10	Channel C Amplitude	Env	4 Bit Control						
R11	Envelope Period	8 Bit Fine Control							
R12		8 Bit Course Control							
R13	Envelope Shape	4 Bit Control							
R14	I/O Port	8 Bit Parallel Port							

PSG REGISTERS

specified VOLUME The command is fairly complex and to make full use of its capabilities experimentation is required

There are four variables or integers involved in the command with a comma separator between each The CHANNEL selection is pretty straightforward selecting the channel that is required OCTAVE 0 starts at two below middle C and increases from there (Middle C is taken as 246 9 Hz) NOTE selects the required semi tone within the chromatic scale and is the same as the Spectrum s BEEP command VOLUME ranges from 0 to 15 the amplitude of the output ranges from 1 (very soft) to 15 (very loud) When the volume is set to 0 control of the output is passed to the envelope generator the parameters of which must be set in an accompanying " PLAY " MUSIC must be used with " PLAY which selects the channels being used and the shape of the sound envelope

```
5 *PLAY 1,0,0,0
10 FOR n = 0 TO 6
20 FOR n - 1 TO 12
30 *MUSIC 1,n,5
40 PAUSE 20
50 NEXT n
60 NEXT n
70 *PLAY 0,0,0,0 REM turn
channels off
```

***SOUND**

Format channel, pitch volume

channel 1 6
pitch 0 65335
volume 0 15

*SOUND lacks the finesse of *MUSIC since its output is not arranged in semitones and it merely blasts out whatever values are input It can be used to generate complex sounds as well as pure tones However it does include a noise generator unlike *MUSIC which allows the creation of sounds which are more useful as a background to games CHANNEL values 1 3 select a tone channel and values 4 6 select which of the three channels the single noise generator will output through PITCH is no more than a div sion

```
10 REM ******************************
20 REM *                            *
30 REM *      THE  STING            *
40 REM *                            *
50 REM *    BY SCOTT JOPLIN         *
60 REM *                            *
70 REM ******************************
80 LOMB 1 ar*1  Pag 64000"CODE
90 LET a=0 GO SUB "GAMEB"
100 LET a1=VAL "8" LET b=VAL " "  LET a2=VAL "8"  LET a3=VAL "8"
110 LET s=VAL "10"  REM gen16 over
120 LET r=VAL "22"  REM rev=on
130 LET a4=VAL "8"  LET a5=VAL "8"  LET a6=VAL "8"
140 LET a7=VAL "8"  LET a8=VAL "8"  LET a9=VAL "8"  LET a10=VAL "8"
150 LET v=VAL "8"  REM SET VOLUME TO SUITABLE START LEVEL
160 REM ********** NOTE IN JEK ******
170 LET d=VAL "1"  LET e=VAL "2"  LET f=VAL "3"  LET g=VAL "4"
180 LET h=VAL "5"  LET i=VAL "6"  LET j=VAL "7"  LET k=VAL "8"
190 LET l=VAL "9"  LET m=VAL "10"  LET n=VAL "11"  LET o=VAL "12"
200 ln 1 * d v ln 2 4 d v ln 3 0 0 0  PRINE s
210 ln 1 5 e v ln 2 4 e v  PRINE s ln 1 5 r v ln 2 4 c v  PRINE s
220 ln 1 d i v ln 2 3 e v  PRINE s ln 1 d r v ln 2 3 n v  PRINE s
230 ln 1 d g v ln 2 3 c v  PRINE s ln 1 d i v ln 2 3 d v  PRINE s
240 ln 1 d i v ln 2 3 e v  PRINE s ln 1 d c v ln 2 3 c v  PRINE s
250 ln 1 d g v ln 2 3 d v  PRINE s ln 1 d i v ln 2 3 e v  PRINE s
260 ln 1 d d v ln 2 3 d v  PRINE s ln 1 d d v ln 2 3 d v  PRINE s
270 ln 1 d c v ln 2 2 e v  PRINE s ln 1 d e v ln 2 2 c v  PRINE s
280 ln 1 d a v ln 2 1 e v  PRINE s ln 1 d c v ln 2 1 e v  PRINE s
290 ln 1 d a v ln 2 1 c v  PRINE s ln 1 d e v ln 2 1 d v  PRINE s
300 ln 1 d g v ln 2 1 g v  PRINE s  ln 0 0 0 0  PRINE s  LET v=v+2
310 ln 1 d g v ln 2 3 e v ln 2 3 g v  ln 7 0 0 0  PRINE s  LET v=v-6
320 ln 1 d d v ln 2 2 e v ln 2 2 g v  PRINE s ln 1 3 d v  PRINE s
330 IF a=VAL "1" THEN LET a1=VAL "1"
340 ln 1 3 c v ln 2 2 c v ln 3 2 c v  PRINE s
350 ln 1 4 c  PRINE s ln 3 9 c v ln 3 8 c v  PRINE s
360 ln 1 3 c v  PRINE s ln 1 4 c v ln 2 2 d v ln 3 1 d v  PRINE s
370 ln 1 3 c v ln 2 2 d v ln 3 2 b v  PRINE s
380 ln 1 4 c v  PRINE s ln 2 2 f v ln 3 1 f v  PRINE s
390 ln 2 3 c  PRINE s ln 3 2 e v  PRINE s ln 2 2 e v ln 3 1 e v  PRINE s
400 IF a=VAL "1" THEN RETURN
410 ln 1 5 c v ln 2 4 e v  PRINE s  LET v=v+1
420 ln 1 5 d v ln 2 4 f v ln 3 2 d v  PRINE s  LET v=v+1
430 ln 1 5 d e v ln 2 4 f v  PRINE s  LET v=v+1
440 ln 1 5 e v ln 2 4 d v ln 3 1 d v  PRINE s
450 ln 1 5 c v ln 2 4 e v  PRINE s ln 1 5 i v ln 2 4 f v ln 3 2 d v  PRINE s
460 ln 1 5 e v ln 2 4 d v  PRINE s ln 3 1 c v  PRINE s
470 ln 1 4 c  ln 2 4 c v  PRINE s ln 1 5 d v ln 2 4 f v ln 3 2 b v  PRINE s
480 ln 1 5 e  ln 2 4 c v ln 3 2 c v  PRINE s
490 IF a=VAL "1" THEN RETURN
500 ln 3 1 c v  PRINE s ln 3 2 c v  PRINE s  LET v=v-2
510 ln 1 3 d v ln 2 8 n v ln 3 2 c v  PRINE s ln 1 3 de v  PRINE s
520 LET l=VAL "1"  LET v=v-1  GO TO 540
530 PRINE s
540 LET v=v+1  ln 1 4 c v ln 2 4 c v ln 3 2 de v  PRINE s  LET v=v+1
550 ln 1 4 c  ln 1 3 d v  PRINE s  LET v=v+1
560 ln 1 4 c  ln 2 3 d v ln 3 1 d v  PRINE s
570 ln 1 4 c v ln 2 3 e v  PRINE s ln 1 4 c v ln 2 4 c v ln 3 2 f v  PRINE s
580 ln 1 5 d v ln 2 4 c v  PRINE s  ln 3 2 d v  PRINE s
590 ln 1 5 d  ln 2 4 d v  PRINT s ln 1 5 c v ln 2 4 c v ln 3 2 i v  PRINE s
600 ln 1 4 c  ln 2 3 e v  PRINE s
610 ln 1 4 c  ln 2 4 c v ln 3 2 h v  PRINE s
620 ln 1 3 c v  PRINE s ln 2 3 c v  PRINE s  LET v=v-1 ln 1 3 d v
630 ln 2 d v ln 3 1 g v  PRINE s  LET v=v-1 ln 1 3 de v  PRINE s
640 LET a1=VAL "2"  GO TO 540
650 ln 2 3 g v  PRINE s ln 3 3 c v  PRINE s ln 0 0 0 0
660 ln 1 3 r v ln 2 4 c v  PRINE s ln 1 3 d v ln 2 4 d v  PRINE s
670 ln 3 2 c v ln 1 7 0 0 0 ln 2 4 g v  PRINE s
680 ln 1 3 c v ln 2 4 c v  PRINE s ln 1 3 d v ln 2 4 d v ln 3 2 c v  PRINE s
690 ln 1 * v ln 2 4 e v  PRINE s ln 3 1 n v  PRINE s
700 ln 1 * c ln 2 4 c v  PRINE s ln 1 3 d v ln 2 4 d v ln 3 3 e v  PRINE s
710 ln 1 3 c  ln 2 4 e v  PRINE s
720 ln 1 3 c v ln 2 4 g v ln 3 1 e v  PRINE s ln 1 3 c v ln 2 4 c v  PRINE s
730 ln 1 3 d v ln 2 4 d v ln 3 2 e v  PRINE s ln 1 3 c v ln 2 4 d v  PRINE s
740 ln 3 1 de v  PRINE s ln 1 3 c v ln 2 4 c v  PRINE s
750 ln 1 3 d v ln 2 4 d v ln 3 2 c v  PRINE s
760 ln 1 * v ln 2 4 c  PRINE s ln 1 3 d v ln 2 4 d v ln 3 3 e v  PRINE s
770 ln 1 3 c  ln 2 4 e v  PRINE s
780 ln 1 3 c v ln 2 4 g v ln 3 1 e v  PRINE s ln 1 3 c v ln 2 4 c v  PRINE s
790 ln 1 3 d v ln 2 4 d v ln 3 2 e v  PRINE s ln 1 3 c v ln 2 4 d v  PRINE s
800 ln 3 1 de v  PRINE s ln 1 3 c v ln 2 4 c v  PRINE s
810 ln 1 3 d v ln 2 4 d v ln 3 2 c v  PRINE s
820 ln 1 5 c v ln 2 4 e v ln 3 2 c v  PRINE s
830 ln 3 1 g v  PRINE s
840 LET v=v-1 ln 3 1 c  PRINE s
850 LET v=v-1 ln 1 3 d v ln 2 2 h  ln 3 1 de v  PRINE s
860 ln 1 3 de v  PRINE s  LET a=VAL "8"  LET a1=1  LET v=v-2  GO TO 540
870 LET a=VAL "8"
880 IF a1=1 THEN  GO TO 1910
890 ln 1 5 c  ln 2 4 g v ln 3 2 c v  PRINE s ln 1 3 g v  PRINE s
900 ln 3 1 c v ln 1 4 c v ln 2 4 c  PRINE s ln 3 8 0 0
910 ln 1 4 c v ln 2 4 e v  PRINE s ln 1 4 fs v ln 2 4 fs v  PRINE s
920 ln 7 0 0 0
930 ln 1 4 g v ln 2 4 e v ln 1 r v ln 3 1 c v  PRINE s
940 ln 1 4 c v ln 2 4 g v ln 3 2 c  PRINE s ln 1 4 0 v ln 2 4 g v
950 IF a1=VAL "1" AND a=VAL "1" THEN  GO TO 990
960 IF a=VAL "1" THEN  RETURN
970 PRINE s
980 ln 3 1 b v  PRINE s ln 1 4 g v ln 2 4 c v  PRINE s
990 ln 1 4 r v ln 2 4 d v ln 3 2 c v  PRINE s ln 1 4 fs v ln 2 4 fs v  PRINE s
1000 IF a=1 AND a1= THEN  LET a=1  GO TO 930
1010 LET a=VAL "1"  GO TO 930
1020 PRINE s
1030 IF a=VAL "1" THEN RETURN
1040 IF a=VAL "1" THEN RETURN
1050 ln 3 1 b v  PRINE s ln 1 4 g v ln 2 4 c v  PRINE s
1060 ln 1 4 r v ln 2 4 d v ln 3 2 c v  PRINE s ln 1 4 fs v ln 2 4 fs v  PRINE s
1070 ln 1 3 d v ln 2 1 f v ln 3 1 e v  PRINE s ln 1 3 d v  PRINE s
1080 ln 1 4 c v ln 2 3 f v  ln 3 1 e v  PRINE s ln 1 3 c v  PRINE s
1090 ln 1 4 c v ln 2 3 d v ln 3 2 c v  PRINE s ln 1 3 d v  PRINE s
1100 ln 1 4 c v ln 2 3 e v ln 3 2 c v  PRINE s ln 1 3 c v  PRINE s
1110 IF a1=1 THEN  RETURN
1120 ln 1 3 d v ln 2 2 e v ln 3 2 d v  PRINE s ln 1 4 c v  PRINE s
1130 ln 1 4 c v ln 2 3 f v ln 3 2 d v  PRINE s ln 1 4 d v  PRINE s
1140 ln 1 4 c  ln 2 3 e v ln 3 2 d v  PRINE s ln 1 4 f v  PRINE s
1150 ln 1 4 d  ln 2 3 c v ln 3 2 c v  PRINE s ln 1 4 f v  PRINE s
1160 LET a=0  LET a4=1  GO TO 930  LET a4=0
1170 ln 3 2 c  PRINE s ln 3 1 d  PRINE s
1180 ln 1 4 c  ln 2 8 d v ln 3 2 d v  PRINE s ln 1 4 bf  PRINE s
1190 ln 1 4 c  ln 3 4 d v ln 3 2 d  PRINE s ln 3 4 0 0  PRINE s
1200 ln 2 7 0 0  PRINE s ln 3 2 g  PRINE s ln 8 0 0 0  PRINE s ln 7 0 0 0
1210 ln 2 4 c v  PRINE s ln 3 2 d v  PRINE s  PRINE s
1220 ln 1 4 fs  ln 2 3 c  ln 3 2 e  PRINE s ln 1 4 d v  PRINE s
1230 ln 1 4 g v ln 3 2 h  ln 3 2 b  PRINE s
1240 ln 3 1 c  PRINE s ln 1 4 g v  PRINE s ln 1 4 g v ln 2 4 c  PRINE s
1250 ln 1 4 d v ln 2 4 d v ln 3 1 d  ln 3 2 d  PRINE s ln 1 4 fs v ln 2 4 d v
1260 PRINE s  LET a4=0  FT a1=1  GO TO 930
1270 ln 1 4 c v ln 2 2 c v ln 3 2 c v  PRINE s ln 3 3 c v ln 3 2 0 v  PRINE s
1280 ln 3 2 c v ln 2 2  PRINE s ln 1 3 g v  PRINE s
1290 LET a=1  ln 1 4 c v ln 2 4 c v ln 3 2 f v  PRINE s ln 3 0 0 0  PRINE s
1300 ln 7 0 0 0 ln 1 3 g v ln 2 3 c v  PRINE s ln 1 4 c  PRINE s
1310 ln 2 3 d v  PRINE s ln 3 2 c  PRINE s ln 1 3 g v  PRINE s ln 1 0 0 0  PRINE s
1320 ln 2 3 d v ln 3 1 c  PRINE s ln 3 2 c  PRINE s
1330 ln 3 g v ln 2 3 c  ln 3 2 g  PRINE s ln 1 4 c v  PRINE s
1340 ln 1 0 0 0  PRINE s ln 7 0 0 0  PRINE s ln 1 4 g v  PRINE s ln 1 4 g v  PRINE s
1350 ln 1 0 0 0  PRINE s ln 3 2 g  PRINE s ln 1 4 c v  PRINE s
1360 ln 1 0 0 0  PRINE s ln 7 0 0 0  PRINE s ln 1 4 g v  PRINE s ln 1 3 c v  PRINE s
1370 ln 1 4 d v ln 2 3 d v ln 3 2 d v  PRINE s ln 1 3 c v  PRINE s
1380 ln 1 3 c v ln 2 3 fs v ln 3 2 d v  PRINE s ln 1 0 0 0  PRINE s
1390 ln 7 0 0 0 ln 1 4 c v  PRINE s ln 1 4 c v ln 2 3 f  ln 3 1 g  PRINE s
1400 ln 1 4 c  PRINE s ln 3 1 g  PRINE s ln 1 4 c  ln 2 3 e v
1410 PRINE s ln 3 2 c v  PRINE s ln 3 1 g v  PRINE s
1420 IF a2= THEN  GO TO 1470
1430 ln 3 1 g v  PRINE s ln 1 4 g v ln 2 4 c v  PRINE s
1440 ln 1 4 f v ln 2 4 d v ln 3 1 d v  PRINE s ln 1 4 fs v ln 2 4 d v  PRINE s
1450 LET a=VAL "8"  FT a1=VAL "1"  LET a2=VAL "1"  LET a3=VAL "8"
1460 LET a4=VAL "8"  LET  mv=2  GO TO 930
1470 ln 3 1 c v  PRINE s
1480 LET a1=VAL "8"  LET a5=VAL "8"  LET a6=VAL "8"  LET a7=VAL "8"
1490 ln 1 0 0 0 ln 1 3 d v  PRINE s ln 1 fs v  PRINE s ln 7 0 0 0
1500 IF a10=8 THEN  LET  mv=1  GO TO 930
1510 ln 1 7 c v ln 2 4 c v ln 3 2 c v  PRINE s ln 3 1 g v  PRINE s
1520 ln 4 0 0 0  PRINE s ln 7 0 0 0 ln 3 2 f v  PRINE s
1530 OUT 221 7  OUT 223 255  PRINT s ln 7 0 0 0
1540 IF a7=VAL "1" THEN  FT a8=VAL "1"
1550 ln 1 7 f v ln 2 4 d v ln 3 1 f v  PRINE s
1560 ln 1 7 e v ln 2 3 c  ln 3 2 e v  PRINE s ln 1 7 f v ln 2 3 d v  PRINE s
1570 ln 1 4 f v ln 2 3 e v ln 3 2 f v  PRINE s
1580 ln 1 7 f v ln 2 3 g v ln 3 2 e v  PRINE s ln 3 1 f v ln 4 0 0 0  PRINE s
1590 ln 1 3 e  ln 2 3 f v ln 3 0 0 0  PRINE s
1600 ln 1 3 d  ln 2 3 d v ln 3 2 d v  PRINE s ln 1 3 e v  PRINE s
1610 ln 1 4 r v ln 2 3 d v ln 3 1 g v  PRINE s ln 1 4 f v  PRINE s
1620 ln 1 4 c v ln 2 3 e v ln 3 2 f v  PRINE s ln 1 3 g v  PRINE s
1630 ln 1 3 c v ln 2 3 g v ln 3 2 c v  PRINE s
1640 ln 1 3 c  PRINE s ln 3 2 c v  PRINE s ln 1 7 0 0
1650 ln 3 2 c  PRINE s ln 3 1 g v  PRINE s ln 1 3 fs v ln 2 3 fs v  PRINE s
1660 ln 1 3 c v ln 2 3 c v ln 3 2 g  PRINE s
1670 ln 1 2 v ln 2 3 c v ln 3 2 c v  PRINE s ln 1 4 c v  PRINE s
1680 ln 1 4 c v ln 2 3 g v ln 3 2 c v  PRINE s ln 1 4 c v  PRINE s
1690 ln 1 4 d v ln 2 3 g v ln 3 1 c v  PRINE s ln 1 4 c v  PRINE s
1700 ln 1 4 d v ln 2 3 e v ln 3 2 c v  PRINE s ln 1 4 r v  PRINE s
1710 IF a5=VAL "1" THEN  GO TO 1980
1720 ln 1 4 c v ln 2 3 fs v ln 3 2 g v  PRINE s
1730 ln 1 4 c v ln 2 3 fs v ln 3 2 g v  PRINE s ln 1 4 d v ln 2 3 c v  PRINE s
1740 ln 3 1 c  PRINE s ln 1 4 fs v ln 2 3 fs v  PRINE s
1750 ln 1 4 d v ln 2 3 b  PRINE s
1760 ln 1 3 c v ln 2 1 g v ln 3 2 g v  PRINE s ln 1 4 f v  PRINE s
1770 ln 1 4 g v ln 2 3 c v ln 3 2 g v  PRINE s ln 1 4 f v  PRINE s
1780 ln 1 4 g v ln 2 3 d v ln 3 2 d v  PRINE s ln 1 4 f v  PRINE s
1790 ln 1 4 g v ln 2 3 e v ln 3 2 g v  PRINE s ln 1 4 f  PRINE s
1800 LET  mv=2  ln 1 4 g v ln 2 3 fs v  PRINE s
1810 ln 6 0 0 0  PRINE s ln 7 0 0 0  PRINE s
1820 OUT 221 7  OUT 223 255  PRINT s ln 7 0 0 0  PRINE s
1830 OUT 221 7  OUT 223 255  PRINT s ln 7 0 0 0  PRINE s
1840 ln 1 4 g  ln 2 3 fs v ln 3 2 g v ln 7 0 0 0  PRINE s
1850 ln 1 4 g v ln 2 3 f v ln 3 2 g v  PRINE s
1860 LET v=v-3  ln 1 3 d v ln 3 0 0 0  PRINE s ln 1 3 g v  PRINE s
1870 ln 1 3 g v  PRINE s ln 1 3 g v  PRINE s ln 2 3 d v ln 3 1 f v
1880 LET a2=VAL "1"  GO TO 1460
1890 ln 1 3 c  ln 2 3 f v ln 3 1 f v  PRINE s ln 1 3 ds v  PRINE s
1900 ln 1 3 c  ln 2 3 d v ln 3 1 d  PRINE s ln 1 4 g v ln 3 1 d v  PRINE s
1910 ln 1 3 c  PRINE s ln 1 4 f v  PRINE s ln 3 1 f v  PRINE s
1920 ln 1 4 c v  PRINE s ln 1 4 e v ln 2 3 g v ln 3 1 g v  PRINE s
1930 ln 1 4 d v  PRINE s ln 1 4 e v ln 2 3 e v  PRINE s
1940 ln 1 4 v  PRINE s ln 2 3 d v ln 3 2 fs v  PRINE s
1950 ln 1 4 v  PRINE s ln 1 4 r v ln 2 3 c v ln 3 2 g  PRINE s
1960 ln 1 4 v  PRINE s ln 1 4 r v ln 2 3 d v ln 3 1 c v  PRINE s
1970 ln 1 4 v  PRINE s ln 1 4 v ln 2 3 e v  PRINE s
1980 ln 1 4 v  PRINE s ln 2 3 f v ln 3 1 g  PRINE s ln 1 4 d  PRINE s
1990 ln 1 4 v  PRINE s ln 1 4 v ln 2 3 g v  PRINE s ln 3 2 c  PRINE s
2000 IF a8=8 THEN  GO TO 2020
2010 GO TO 2050
2020 ln 1 0 0 0 ln 1 3 g v  PRINT s ln 1 3 g  PRINE s ln 1 3 g  PRINE s
2030 ln 1 3 c v  PRINE s  LET a8=VAL "1"  FT a5=VAL "8"  LET a5=VAL "8"
2040 ln 7 0 0 0  GO TO 540
2050 LET v=v+1
2060 ln 1 3 g  PRINE s LET v=v+1 ln 1 3 c v ln 2 4 e v ln 3 1 c v  PRINE s
2070 ln 0 0 0 0  STOP
2080 ENTER "a$ " "THE STING"
2090 SAVE "a$" " THE STING"  LINE 10
2100 VERIFY "a$" " THE STING"
```

```
HEX DISASSEMBLY OF *COMMANDS

FA00  01 09 FA ED   FA8C  81 87 21 27   FB18  07 85 D7 94   F8AC  2C C2 F0 01
FA04  43 07 5C C9   FA90  FA 06 00 4F   FB1C  1E FE 18 30   FBB0  D7 20 00 D7
FA08  D7 10 00 FE   FA94  89 7E 23 46   F020  35 A7 20 02   FBB4  82 1C CD 87
FA0C  2A C2 F0 01   FA98  4F ED 43 F3   F024  C6 10 32 F1   FBB8  05 D7 99 1E
FA10  D7 20 00 C8   FA9C  58 D7 94 1E   F028  58 D7 99 1E   FBBC  79 32 F1 58
FA14  EF FE 6D CA   FAA0  FE 07 38 46   F02C  79 32 F3 58   FBC0  78 32 F3 58
FA10  3F FA FE 73   FAA4  3C ED 48 F4   F030  78 32 F5 58   FBC4  3E 08 32 F8
FA1C  CA EF FA FE   FAA8  58 47 3A F3   F034  D7 94 1E FE   FBC8  56 3C 32 F2
FA20  70 CA 83 F8   FAAC  5B 10 07 C8   F038  07 30 18 A7   FBCC  5B D7 94 1E
FA24  C3 F0 01 F1   FAB0  19 C8 09 C8   F03C  20 18 F5 F5   FBD0  FE 09 30 47
FA28  06 8E 06 30   FAB4  1F A7 10 F7   F040  FE 04 30 15   FBD4  A7 28 02 C6
FA2C  06 D7 05 03   FAB8  32 F3 58 79   F044  C6 07 32 F0   FBD8  07 32 F5 58
FA30  05 34 05 E9   FABC  32 F5 5B D7   F048  58 F1 D6 01   FBDC  3E 0D 32 F4
FA34  04 A2 04 60   FAC0  94 1E FE 04   F04C  87 32 F2 58   FBE0  58 3E 07 32
FA38  04 20 04 E6   FAC4  30 26 A7 28   F050  3C 32 F4 58   FBE4  F6 5B D7 94
FA3C  03 AE 03 D7   FAC8  23 F5 C6 07   F054  18 10 D7 F9   FBEB  1E FE 08 30
FA40  74 A0 FE 20   FACC  32 F0 58 F1   F058  24 C6 04 32   FBEC  2E C8 27 C8
FA44  28 88 FE 3A   FAD8  D6 81 87 32   F05C  F0 58 F1 3E   FBF0  27 C9 27 32
FA48  28 04 FE 0D   FAD4  F2 58 3C 32   F060  06 32 F2 58   F0F4  F7 50 D7 94
FA4C  20 F1 D7 82   FAD8  F4 58 B6 03   F064  32 F4 5B 3A   F0F8  1E FE 08 30
FA50  1C FE 2C C2   FADC  21 F0 50 7E   F068  F3 58 32 F5   F0FC  1E 21 F7 58
FA54  F0 01 D7 20   FAE8  D3 DD 23 7E   F06C  58 FE 20 30   FC00  06 2F 32 F7
FA58  00 D7 82 1C   FAE4  D3 DF 23 10   F070  E5 06 03 21   FC04  58 FE FF 28
FA5C  FE 2C C2 F0   FAE8  F6 C3 C1 05   F074  F0 58 7E D3   FC08  15 06 04 21
FA60  01 D7 20 00   FAEC  D7 F9 24 D7   F078  DD 23 7E D3   FC0C  F0 50 7E D3
FA64  D7 82 1C FE   FAF0  74 00 FE 20   F07C  DF 23 10 F6   FC10  DD 23 7E D3
FA68  2C D7 20 08   FAF4  28 08 FE 3A   F080  C3 C1 B5 D7   FC14  DF 23 10 F6
FA6C  D7 82 1C CD   FAF8  28 04 FE 0D   F084  74 00 FE 20   FC18  C3 C1 B5 D7
FA70  87 05 D7 94   FAFC  20 F1 D7 82   F088  28 00 FE 3A   FC1C  F9 24 AF 32
FA74  1E FE 18 3B   F000  1C FE 2C C2   F08C  28 04 FE 0D   FC20  F0 58 32 F1
FA78  73 A7 28 02   FB04  F0 01 D7 2B   F090  20 F1 D7 82   FC24  58 06 0E 21
FA7C  C6 10 32 F1   F008  88 D7 82 1C   F094  1C FE 2C C2   FC28  F0 58 7E D3
FA80  50 D7 94 1E   F00C  FE 2C C2 F0   F098  F0 01 D7 20   FC2C  DD 34 23 7E
FA04  FE 0D 38 64   F010  01 D7 20 80   F09C  0B D7 82 1C   FC30  D3 DF 10 F3
FA08  A7 28 61 D6   F014  D7 82 1C CD   F0A0  FE 2C C2 F0   FC34  3E 07 D3 DD
                                        F0A4  01 D7 20 00   FC38  3E FF D3 DF
                                        F0A0  D7 82 1C FE   FC3C  C3 C1 05 00
```

of the clock frequency A small number will probably have your dog jumping around as the sound is ultrasonic VOLUME is the same as the other commands 1 (quiet) to 15 (very loud) and 0 to enable the envelope to control the output

*SOUND must be enabled with the appropriate select on in the *PLAY to enable the selected channel and is turned off by * PLAY 0.0.0.0

```
10 REM sound demo
15 *PLAY 1.0.0.0
20 FOR p=1 TO 500 STEP 10
30 *SOUND 1.8 *p.5
40 PAUSE 10
50 *SOUND 1.4 *p.5
60 PAUSE 10
65 *SOUND 1.12 *p.5
67 PAUSE 10
70 NEXT p
80 *PLAY 0.0.0.0
```

The Shape of Things To Come

It is not possible to tune a keyed instrument to a diatonic scale exactly and so the equal tempered scale was evolved in which every interval has the same frequency ratio of 12 2 (1 05946) — a complete octave having a ratio of 2 1 being effected in twelve notes

The tones generated by the PSG are obtained by dividing the clock frequency input by 16 and then programmable divisions of this frequency by PITCH or preset divisions for NOTE and OCTAVE The PSG has a maximum clock frequency of 2MHz and values as close to this as possible are preferred The table within the program uses as its base the C two octaves below middle C — a frequency of 65Hz which is the bass for all calculations and is OCTAVE 0 NOTE 1 The components specified in the circuit gave a frequency of approximately 1 86MHz There is a fixed division of 16 inside the PSG and this resulting frequency of 116 25KHz is the output when both course and fine registers of a channel are set to zero This frequency is divided by 1777 to give 65Hz so 1777 is the base value required for the table contained in the program This base value can be altered to tune the PSG to a piano or other musical instrument and the other 11 values can be calculated by repeated division to obtain the other values and inserted into the program

C	1777	(65 4Hz)
C#	1678	(69 3Hz)
D	1584	(73 4Hz)
D#	1495	(77 8Hz)
E	1411	(82 4Hz)
F	1332	(87 3Hz)
F#	1257	(92 5Hz)
G	1186	(98 0Hz)
Ab	1120	(103 8Hz)
A	1056	(110 0Hz)
Bb	998	(116 6Hz)
B	942	(122 5Hz)

```
                  0010          "MACHINE CODE AND ASSEMBLY LANGUAGE"
                  0020          "FOR EXTENDED BASIC * COMMANDS
                  0030          "TO HARDWARE AND SOFTWARE
                  0040           COPYRIGHT 1985"
                  0050
                  0060
                  0070
FA00              0080          ORG  $4A00
                  0090
                  0100
                  0110
0018              0120 FETCH EQU  18H
0020              0130 MATCH EQU  20H
0024              0140 FWRDD EQU  24H
01F8              0150 ERRF  EQU  01F8H
0527              0160 STEND EQU  0527H
0501              0170 END1  EQU  0501H
1C02              0180 EXPT1 EQU  1C02H
1E94              0190 FINT1 EQU  1E94H
1F99              0200 FINT2 EQU  1F99H
2028              0210 STACK EQU  2028H
5F00              0220 MSTR  EQU  5F00H
                  0230
                  0240
FA00 010AFA       0250 INIT  LD   BC,START
FA03 ED42B7B0     0260        D   ,23735,BC
FA07 C9           0270        RET
                  0280
                  0290
                  0300
FA08 D7           0310 START RST  10H
FA09 1B00         0320        DEFW FETCH
FA0B FE2A         0330        CP   '*'
FA0D 20F801       0340        JR   NZ,ERRF
FA10 D7           0350        RST  10H
FA11 2000         0360        DEFW MATCH
FA13 06FF         0370        LD   B,0
FA15 FE60         0380        CP   '`'
FA17 06FFFF       0390        JR   Z,MUSIC
FA1A FE22         0400        CP   '"'
FA1C 06FFFF       0410        JR   Z,SOUND
FA1F FE58         0420        CP   'X'
FA21 06FFFF       0430        JR   Z,PLAY
FA24 20F801       0440        JR   NZ,ERRF
                  0450
                  0460
                  0470
                  0480
                  0490
FA27 F1D6         0500 TABLE DEFW 1777
FA29 8F06         0510        DEFW 1678
FA2B 3D05         0520        DEFW 1584
FA2D D705         0530        DEFW 1495
FA2F 9B05         0540        DEFW 1411
FA31 3A05         0550        DEFW 1332
FA33 E304         0560        DEFW 1257
FA35 8C04         0570        DEFW 1186
FA37 5004         0580        DEFW 1120
FA39 2004         0590        DEFW 1056
FA3B E403         0600        DEFW 996
FA3D AF03         0610        DEFW 940
                  0620
                  0630
                  0640
                  0650
                  0660          "MUSIC  ( 7)
                  0670          "(CTRVE 0-5"
                  0680          "NOTE   )-12"
                  0690          "  ATION 0-15"
                  0700
                  0710
                  0720          "MUSIC SYNTAX"
                  0730
                  0740
FA3E D7           0750 MUSIC RST  10H
FA40 7400         0760        DEFW FWRDD
FA42 FE28         0770        CP   '('
FA44 2006         0780        JR   Z,M1
FA46 FE29         0790        CP   ')'
FA48 2804         0800        JR   Z,M1
FA4A FE80         0810        CP   80H
FA4C 20F1         0820        JR   NZ,MUSIC
FA4E D7           0830 M1    RST  10H
FA4F 821C         0840        DEFW EXPT1
FA51 FE2C         0850        CP   ','
FA53 C2F801       0860        JP   NZ,ERRF
FA56 D7           0870 OCT   RST  10H
FA57 2000         0880        DEFW MATCH
FA59 D7           0890        RST  10H
FA5A 821C         0900        DEFW EXPT1
FA5C FE2C         0910        CP   ','
```

```
FA5E C2F801       0920        JP   NZ,ERRF
FA61 D7           0930        RST  10H
FA62 2000         0940        DEFW MATCH
FA64 D7           0950        RST  10H
FA65 821C         0960        DEFW EXPT1
FA67 FE2C         0970        CP   ','
FA69 D          0980          RST  10H
FA6A 2000         0990        DEFW MATCH
FA6C D7           1000        RST  10H
FA6D 821C         1010        DEFW EXPT1
FA6F CDA705       1020        CALL STEND
                  1030
                  1040
                  1050          "MUSIC RUN-TIME"
                  1060
FA72 D7           1070 M4    RST  10H
FA73 941F         1080        DEFW FINT1
FA75 FE10         1090        CP   16
FA77 C2F8         1100        JR   NC,ERRM
FA79 A7           1110        AND  A
FA7A 2002         1120        JR   NZ,M4
FA7C C610         1130        ADD  16
FA7E 32F15B       1140 M4    LD   (MSTR+1),A
                  1150
                  1160
FA81 D7           1170 NOTE  RST  10H
FA82 941E         1180        DEFW FINT1
FA84 FE00         1190        CP   18
FA86 38F4         1200        JR   NC,ERRM
FA88 A7           1210        AND  A
FA89 2861         1220        JR   Z,ERRM
FA8B D601         1230        SUB  1
FA8D D7           1240        RST  A
FA8E 2.07FA       1250        D   HL,TABLE
FA91 060A         1260        LD   B,A
FA93 4F           1270        LD   C,A
FA94 09           1280        ADD  HL,BC
FA95 7E           1290        LD   A,(HL)
FA96 23           1300        INC  HL
FA97 46           1310        LD   B,(HL)
FA98 4F           1320        LD   C,A
FA99 ED43F3B      1330        LD   (MSTR+3),BC
                  1340
                  1350
FA9D D7           1360 OCT   RST  10H
FA9E 941E         1370        DEFW FINT1
FAA0 FE07         1380        CP   7
FAA2 3848         1390        JR   NC,ERRM
FAA4 3C           1400        INC  A
FAA5 ED4BF45B     1410        LD   BC,(MSTR+4)
FAA9 47           1420        LD   B,A
FAAA 3AF35B       1430        LD   A,(MSTR+3)
FAAD 1807         1440        JR   COUNT
FAAF CB19         1450 HALF  RR   C
FAB1 CBB9         1460        RES  7,C
FAB3 CB1F         1470        RR   A
FAB5 A7           1480        AND  A
FAB6 10F7         1490 COUNT DJNZ HALF
FAB8 32F35B       1500        LD   (MSTR+3),A
FABB 79           1510        LD   A,C
FABC 32F55B       1520        LD   (MSTR+5),A
                  1530
                  1540
FABF D7           1550 CHRN  RST  10H
FAC0 941E         1560        DEFW FINT1
FAC2 FE04         1570        CP   4
FAC4 3006         1580        JR   NC,ERRM
FAC6 A7           1590        AND  A
FAC7 2823         1600        JR   Z,ERRM
FAC9 F5           1610        PUSH AF
FACA C607         1620        ADD  7
FACC 32F2B9       1630        LD   (MSTR),A
FACF F1           1640        POP  AF
FAD0 D601         1650        SUB  1
FAD2 A7           1660        AND  A
FAD3 32F25B       1670        LD   (MSTR+2),A
FAD6 3C           1680        INC  A
FAD7 32F45B       1690        LD   (MSTR+4),A
FADA 4603         1700        LD   B,3
                  1710
                  1720
FADC 21F25B       1730 OUTPT LD   HL,MSTR
FADF 7E           1740 LOOP  LD   A,(HL)
FAE0 D300         1750        OUT  (221),A
FAE2 23           1760        INC  HL
FAE3 7E           1770        LD   A,(HL)
```

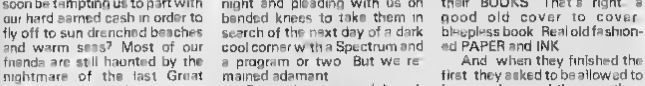
```
FAE4 D30F      1710        OUT  (223) A
FAE6 23        1720        INC  HL
FAE7 10F6      1730        DJNZ LOOP
FAE9 C3C105    1740        JP   END1
               1750 ;
               1760
FAEC D7        1770 FRAM   RST  10H
FAED F924      1780        DEFW 24F9H
               1790
               1800
               1810
               1820 ;                 *CHANE  1-6F
               1830                   *FRFQTND A-65535
               1840                    VOL    A-15
               1850
               1860 ;
               1870                   *SOUND SYNTAX
               1880
               1890
FAEF D7        1900 SOUND  RST  10H
FAF0 7400      1910        DEFW CHRDD
FAF2 FE28      1920        CP   "("
FAF4 2006      1930        JR   Z,S1
FAF6 FE30      1940        CP   "0"
FAF8 2004      1950        JR   Z,S1
FAFA FE80      1960        CP   80H
FAFC 28F1      1970        JR   NZ,SOUND
FAFE D7        1980 S1     RST  10H
FAFF 821C      1990        DEFW EXPT1
FB01 FE2C      2000        CP   ","
FB03 C2FB01    2010        JP   NZ,ERR6
FB06 D7        2020        RST  10H
FB07 2000      2030        DEFW NXTCH
FB09 D7        2040        RST  10H
FB0A 821C      2050        DEFW EXPT1
FB0C FE2C      2060        CP   ","
FB0E C2FB01    2070        JP   NZ,ERR6
FB11 D7        2080        RST  10H
FB12 2000      2090        DEFW NXTCH
FB14 D7        2100        RST  10H
FB15 821C      2110        DEFW EXPT1
FB17 CD8F85    2120        CALL STEMC
               2130
               2140
               2150 ;                 SOUND N,N H-TIME
               2160
               2170
               2180
FB1A D7        2190 VOL5   RST  10H
FB1B 941E      2200        DEFW FINT1
FB1D FE18      2210        CP   18
FB1F 3005      2220        JR   NC,ERR6
FB21 B7        2230        AND  A
FB22 20F2      2240        JR   NZ,FRAM
FB24 CB18      2250        RRD  (HL)
FB26 32F1FB    2260        LD   (METR41),A
               2270
               2280
FB29 D7        2290 PER    RST  10H
FB2A 931E      2300        DEFW FINT2
FB2C 79        2310        LD   A,C
FB2D 32F3FB    2320        LD   (METR42),A
FB30 3A        2330        LD   A,(DE)
FB31 32F5FB    2340        LD   (METR43),A
               2350
               2360
FB34 D7        2370 CHANS  RST  10H
FB35 941E      2380        DEFW FINT1
FB37 FE07      2390        CP   7
FB39 B7        2400        AND  A
FB3A 201F      2410        JR   NZ,ERR6
FB3C B7        2420        AND  A
FB3D 201A      2430        JR   Z,ERR6
FB3F F5        2440        PUSH AF
FB40 FEF4      2450        CP   -12
FB42 381F      2460        JR   NC,D1
FB44 D607      2470        SUB  7
FB46 32F8FB    2480        LD   (METR)A
FB49 F1        2490        POP  AF
FB4A D601      2500        SUB  1
FB4C B7        2510        AND  A
FB4D 32F6FB    2520        LD   (METR42)A
FB50 3C        2530        INC  A
FB51 32F4FB    2540        LD   (METR44)A
FB54 1818      2550        JR   D2
```

```
               2560
               2570
FB56 D7        2580 ERR6   RST  10H
FB57 F924      2590        DEFW 24F9H
               2600
               2610
FB5A D604      2620 D1     SUB  4
FB5C 32F8FB    2630        LD   (METR),A
FB5F F1        2640        POP  AF
FB60 B5        2650        OR   L
FB61 32F7FB    2660        LD   (METR44),A
FB64 32F4FB    2670        LD   (METR44),A
FB67 3AF8FB    2680        LD   A,(METR)
FB6A 32F6FB    2690        LD   (METR42),A
FB6D FE28      2700        CP   "("
FB6F 30F2      2710        JR   NC,ERR6
FB71 3AF8FB    2720 D2     LD   A,(METR)
FB74 21F8FB    2730        LD   HL,METR
FB77 7E        2740 LOOP   LD   A,(HL)
FB78 D300      2750        OUT  (251),A
FB7A 23        2760        INC  HL
FB7B 7E        2770        LD   A,(HL)
FB7C D300      2780        OUT  (251),A
FB7E 23        2790        INC  HL
FB7F 10F8      2800        DJNZ LOOP
FB81 C3C105    2810        JP   END
               2820
               2830
               2840                   *TONE  1-7
               2850                    INTER  0-3
               2860                    ENV    0-8
               2870                    PER OF 0-65535
               2880
               2890 ;                 E.HY  INTE *
               2900
FB84 D7        2910 PLAY   RST  10H
FB85 7400      2920        DEFW CHRDD
FB87 FE28      2930        CP   "("
FB89 2006      2940        JR   Z,S1
FB8B FE30      2950        CP   "0"
FB8D 2004      2960        JR   Z,S1
FB8F FE80      2970        CP   80H
FB91 28F1      2980        JR   NZ,PLAY
FB93 D7        2990 S1     RST  10H
FB94 821C      3000        DEFW EXPT1
FB96 FE2C      3010        CP   ","
FB98 C2FB01    3020        JP   NZ,ERR6
FB9B D7        3030        RST  10H
FB9C 2000      3040        DEFW NXTCH
FB9E D7        3050        RST  10H
FB9F 821C      3060        DEFW EXPT1
FBA1 FE2C      3070        CP   ","
FBA3 C2FB01    3080        JP   NZ,ERR6
FBA6 D7        3090        RST  10H
FBA7 2000      3100        DEFW NXTCH
FBA9 D7        3110        RST  10H
FBAA 821C      3120        DEFW EXPT1
FBAC FE2C      3130        CP   ","
FBAE C2FB01    3140        JP   NZ,ERR6
FBB1 D7        3150        RST  10H
FBB2 2000      3160        DEFW NXTCH
FBB4 D7        3170        RST  10H
FBB5 821C      3180        DEFW EXPT1
FBB7 FE2C      3190        CP   ","
FBB9 C2FB01    3200        JP   NZ,ERR6
FBBC D7        3210        RST  10H
FBBD 2000      3220        DEFW NXTCH
FBBF D7        3230        RST  10H
FBC0 821C      3240        DEFW EXPT1
FBC2 FE28      3250        CP   "("
FBC4 2006      3260        JR   Z,S1
FBC6 FE30      3270        CP   "0"
FBC8 2004      3280        JR   Z,S1
FBCA FE80      3290        CP   80H
FBCC 28F1      3300        JR   NZ,PLAY
FBCE D7        3310 S1     RST  10H
FBCF 941E      3320        DEFW FINT1
FBD1 FE09      3330        CP   9
FBD3 3047      3340        JR   NC,ERR6
FBD5 A7        3350        AND  A
```

```
FBD5 2802    3410        JR  Z ENV1
FBD7 D607    3420        ADD  7
FBD9 32F55B  3430 ENV1   LD  (MSTR+5) A
FBDC 3E07    3440        LD  A 13
FBDE 32F4FB  3450        LD  (MSTR+4) A
             3460 ;
             3470
FBE1 3E07    3480 NOTSE  LD  A 7
FBE3 32F65B  3490        LD  (MSTR+6) A
FBE6 D7      3500        RST  10H
FBE7 941E    3510        DEFW FINT1
FBE9 FE09    3520        CP  9
FBEB 302E    3530        JR  NC ERRP
FBED C627    3540        ADD A
FBEF F627    3550        SLA  A
FBF1 C627    3560        SLA  A
FBF3 32F75B  3570        LD  (MSTR+7) A
             3580
             3590 ;
FBF6 D7      3600 TONE   RST  10H
FBF7 941F    3610        DEFW FINT1
FBF9 FE09    3620        CP  9
FBFB 301E    3630        JR  NC ERRP
FBFD 21F75B  3640        LD  HL MSTR+7
FC00 B6      3650        OR  (HL)
             3660 ;
             3670
FC01 2F      3680 T1     CPL
FC02 32F75B  3690        LD  (MSTR+7) A
FC05 FEFF    3700        CP  255
FC07 2815    3710        JR  Z RESET
FC09 0604    3720        LD  B 4
FC0B 21F85B  3730        LD  HL MSTR
FC0E 7E      3740 LOOPP  LD  A (HL)
FC0F D6DD    3750        OUT  (221) A
FC11 23      3760        INC  HL
FC12 7E      3770        LD  A (HL)
FC13 D6DF    3780        OUT  (223) A
FC15 23      3790        INC  HL
FC16 10F6    3800        D NZ LOOPP
FC18 C3C103  3810        JP  END1
FC1B D7      3820 ERRP   RST  10H
FC1C F924    3830        DEFW 24FCH
             3840
             3850
FC1E AF      3860 RESET  XOR  A
FC1F 32F85B  3870        LD  (MSTR) A
FC22 32F75B  3880        LD  (MSTR+1) A
FC25 0E0E    3890        LD  B 14
FC27 21F85B  3900 AGAIN  LD  HL MSTR
FC2A 7E      3910        LD  A (HL)
FC2B D6DD    3920        OUT  (221) A
FC2D 34      3930        INC  (HL)
FC2E 23      3940        INC  HL
FC2F 7E      3950        LD  A (HL)
FC30 D6DF    3960        OUT  (223) A
FC32 10F3    3970        D NZ AGAIN
FC34 0E07    3980        LD  B 7
FC36 D6DD    3990        OUT  (221) A
FC38 3EFF    4000        LD  A 255
FC3A D6DF    4010        OUT  (223) A
FC3C C3C103  4020        JP  END1
             4030 END    END
END    FC3F  AGAIN FC27   RESET FC1E
ERRP   FC1B  LOOPP FC0E   T1    FC01
TONE   FBF6  NOISE FBE1   ENV1  FBD9
ENV    FBD0  RERPL FBB4   S1    FB92
PLAY   FB83  LOOPS FB76   P2    FB71
C1     FB63  ERRR  FB56   CHANS FB14
PER    FB29  VM1   FB28   VOLS  FB1A
S1     FAFE  SOUND FAEF   CHAN  FAEC
LOOP   FADF  OUTPT FADC   CHAN  FAAE
COUNT  FAA6  HALF  FAAF   OCT   FAAD
NOTE   FA81  VM1   FA7E   VM    FA72
M1     FA4E  MUSIC FA3F   TABLE FA27
START  FA08  INIT  FA00   MSTR  3BF8
STAKA  2028  FINT2 1E99   FINT1 1E94
EXPT1  1DA2  END1  9C01   STEND 3587
ERRR   31F8  CHARD 0074   NXTCH 0020
GETCH  001A  *     5E1B
```

Tortoise Wise

Lines from a parent who gets left behind. By David Stewart.



Oh Boy is Winter really upon us? Is it nearly Christmas already? Will our telly screens soon be tempting us to part with our hard earned cash in order to fly off to sun drenched beaches and warm seas? Most of our friends are still haunted by the nightmare of the last Great British Summer We d been tempted this time last year and this summer we took the two boys to where the skies were blue the sun shone every day TV programmes were hardly ever in English and they couldn t get their busy little fingers on a keyboard or a joystick

There were of course the usual painful withdrawal symptoms Pale faces vacant stares twitching trigger fingers waking us up in the middle of the night and pleading with us on bended knees to take them in search of the next day of a dark cool corner with a Spectrum and a program or two But we remained adamant

Enjoy the scenery ' I said Look see that? It s the sun It gives us daylight Remember Daylight? And they tried They tried hard With the most extraordinary results

We had taken a book for each of them to ease the pain in those micro less weeks You may judge for yourself how desperate they had become by the third or fourth day away from their computer when I told you that they began to READ their BOOKS That s right a good old cover to cover bleepless book Real old fashioned PAPER and INK

And when they finished the first they asked to be allowed to buy another and then another and another and we couldn t stop them They took to books like people take to aspirin for hangovers It was costing us a fortune in foreign currency and hours every few days to find a bookshop

Look I said in desperation once more You will have to buy your own books with your holiday money from now on And they did though not without protest Not to me but to each other

This is ridiculous ' said Number One Hare to his brother

We ll never be able to afford to read when we get back home

Excuse me I interrupted You could go along to the Public Library

LIBRARY they mouthed slowly as if the word were part of a foreign language I could see they were searching their memories for data entered a long time ago on that part of Western Childhood

Oh yes they sighed You can borrow books there can t you?

I wonder Tortoisewise how many other words concepts and expressions in this great language of ours are buried that deep in the vocabularies and experiences of today s young micro addicts? It s a thought for Tortoises everywhere And that reminds me thanks to all of you who have written and told me stories of parents who get left behind when it comes to their offspring and computers Keep them coming I'll be featuring some in this column next time

Harwood's Hypothesis

This month we have only four books appearing on this page. This could be due to the fact that publishers aren't letting us reviewers get our hands on the books and then beating them into pulp or more likely it is because the computer book market is starting to falter. Will it eventually collapse?

The problem lies at the hands of two parties. The publishing industry and the computer owner. The former because they knew too early what a good thing was and rushed out and produced books to do this and that on all types of computer completely flooding the market which then slackens as everyone who wants one has got one.

Another reason for the fall in the market is that all readers who wanted a book with lists of arcade games have by now got them. Then to produce a book on the Spectrum with lists of games after games is just pointless. Who would buy a new book when there have been thousands on the market for ages already?

That is why generally the books this month are starting to move away from the idea that people just want to program their machine to play space invaders.

Spectrum Wargaming
Collins
£9.95

The first book of the four is called *Spectrum Wargaming* by Owen and Audrey Bishop and is published by Collins.

Wargames concentrate on tactics and the disposal and control of forces. Wargaming can be played either on a board as in the usual board games or more often a table with models representing houses, soldiers, guns etc. You can achieve a high level of realism and accuracy in setting up the wargaming table and this I am told is half the fun of wargaming to its dedicated followers.

With a computer it is possible if you are not interested that much in converting the dining room into a battle field to play the complete war game on the TV screen although this method does lack the realism that most wargamers enjoy.

The book explains the principles of wargaming from the setting of the scene to the complex rules system. The book initially introduces wargaming and then delves into the 'computer wargame' with a number of wargames listings.

It is possible using the book to get the wargames up and running without any prior knowledge of computing. Four wargames are included in the book so without any delay apart from the laborious keying in, you can turn your Spectrum immediately into a war machine.

If you want a little bit more than just to play a war game, then this book is definitely for you. The authors have written routines that allow wargames to be tailor made depending on the data that is entered for the game. Basically the wargame program is very short and is used as the controller of all the computer data. This data is the bulk of the game.

The wargame is moulded together by using various utilities, ie TABLEMAKER, ARMYMAKER and MAPMAKER. These utilities set up all the necessary wargaming data. The TABLEMAKER utility is used to set up the CRTs (not Cathode Ray Tubes but Combat Resolution tables) which are basically the standard rules of the game, eg number of turns per side, weapon usage, etc. ARMYMAKER is used to detail information about each side and MAPMAKER to describe the terrain and stress of the battlefield. All these details amount to a vast amount of data and because of this the information is directly compressed into the bytes of the RAM instead of using BASIC variables. Variables take up on average 6 bytes where we need use only one or less by directly accessing the RAM. DATASTORER is used to compress all the data entered from the various utilities into the RAM so it is easily accessed by a wargaming controller module.

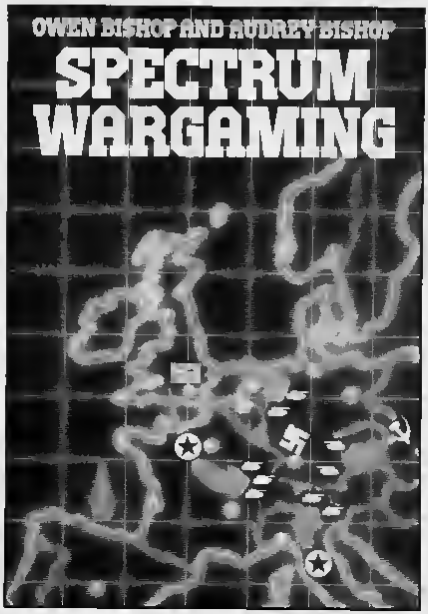
The remainder of the book consists of the wargames. The first game is used only for example and does not make use of the ARMYMAKER utility but only the TABLEMAKER. This is to give the reader a feel for wargaming before jumping into it straight away. After doing this, the reader may enter the fully computerised version of the same battle including maps of the terrain and German and French armies fighting against each other.

The other games included are a Napoleonic Campaign, a medieval battle and a conflict in outer space.

The authors have taken great lengths so that this book is adaptable to all aspects of wargaming, as well as using the full potential of the computer. Wargaming can be played between two Spectrums on an interface connection and details on how to achieve this are included.

The book is an excellent opener for anyone who wants to get into wargaming or even for the experienced manual wargamer. The book is well written and takes the reader carefully through each section, so that by the end of the book he or she will be writing their own war games or at least adapting the ones in the book.

A very intelligent book well thought out and enough to keep anyone occupied over the



winter months. Any wargame has the capability to be programmed and this book provides you with the information you need. At £9.95 you may feel it is a bit expensive but for the information inside I would rather have this book than two games tapes any day.

Political and Military Simulation Games
Interface
£7.95

Remaining with the non arcade idea the next book is *Creating Political and Military Simulation Games on Your Micro*. Bit of a mouthful, eh? The book is written by Mike Rose and published by Interface.

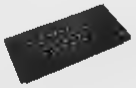
The book is split into two sections. The first explains how to turn the initial idea into a computer program and the second contains ten programs illustrating the first section. Although the title only mentions political and military games the book covers military, political and economic games. Perhaps there wasn't enough room on the front page to fit the whole title in! Military games come in two types: True military which is the wargaming as above and then the strategic military. This is the type used in the book.

The reader is taken through step by step, starting with the planning of the game and progressing till a complete model of the game is present. All aspects of the game are mentioned in the book and examples for each different group are given at each stage. This simplifies the idea as it is much easier to learn something with three examples instead of one. By the end of the first section one should have a complete flow chart showing the structure of the game.

My first niggle comes at this point. In the introduction, we are told that the book requires only a relatively elementary knowledge of computing — only enough to put logical flowcharts into BASIC. Why then is it necessary to flowchart the structure of a YES/NO question? This should appear pretty obvious to anyone with the slightest of programming knowledge.

Another chapter which is also not very useful is the debugging and trouble shooter. The only thing this would be helpful for is NOT committing suicide. It says NOT to jump out of the

How to Write ZX Spectrum and Spectrum + Games Programs



window if an error occurs!

The remainder of the book consists of ten programs from a naval battle in Elizabethan Times to being a Prime Minister at 10 Downing Street (much the same I suppose?). These programs are well written and quite interesting to play but nothing spectacular. I did like Nuclear Crisis where the aim is to persuade the other countries to give you land.

In general the book is ideal for anyone with a knowledge of BASIC and who wants more out of their computer than space invaders. I did feel that at times the book expects you to know a lot more than at other times. But still an interesting book though perhaps slightly overpriced at £7.95.

How To
Babani Books

This book is the one that is contrary to my point in the first paragraphs claiming that the reader is not interested in the usual games programs any more.

How To Write ZX Spectrum and Spectrum + Games Programs book is a step by step guide to writing games programs and does at times assume the reader to be ignorant of computing and at other times to know it all. On the first page the invaluable REM statement is again explained, but at this point the reader is expected to know all about FOR ... NEXT loops and the PRINT AT statement. The reader is also told how to get an asterisk on the screen by pressing Symbol Shift and B but not how to get any of the other statements. Double Dutch if you ask me!

The step-by-step guide could be useful to the novice programmer but perhaps the author thought that just a games book wouldn't sell too well so the idea of learning how to program games seemed a better prospect. The programs are in separate chapters and by the end of the first chapter the reader should know how to use the UDG's and the PLOT and DRAW statements. The games are separated into individual routines and the author does his best to explain each routine demonstrating how the game is moulded together. The games are at most for six players but never included is the capability of playing with the computer. There is a chess game, but only the bare structure as the CHESS game in the book is only for two players and does not have the facility to compete with the computer. I would rather get the good old fashioned chess board out. This way is much more real.

The programs also did not appear to be all that well written. I could easily re write a few sections if I was going to use the book to any great length. The listings also, due to the width of the book, were hard to read and appeared somewhat compact but the programs could be adapted to improve the games which in my mind only half succeeded.

At £2.50 the book is reasonably priced and it may appeal to those who have some ideas but have difficulty in transferring them onto a computer but otherwise I cannot really see the book as being extremely beneficial to anyone. Why would anyone want to draw a River Nile Scene in a game? Just another way of filling out a chapter.

Data Management at Work
Pan Books
£2.95

The final book is not intended for home computer users but business users. The book does not relate to the ZX range of computers but is ideal for anyone thinking of computerising their business, either at home or in the office.

The book is called *Data Management At Work* written by Kathy Lang and published by Pan. A the title suggests the book introduces the reader to some of the capabilities of a business computer and the use of a Data Management System or Data Base System. A data base system is briefly a way of dealing with structured information (the simplest example is the card index system).

The author starts by presenting a problem in a social club and the ideas behind turning the manual process into a fully automated computer system. The case study is at first presented and the situation evaluated so the reader can see examples of typical uses of a data base or management computer system. Before using a data base system and writing an application program the manual method needs to be analysed so that it is possible to see what the computer can find cannot do.

The book starts off by analysing the social club example and turns this into a real life situation explaining how the manual method can be computerised. The reader is taken through the various stages of the data base system from the format of the records to the report structures that will be needed.

The author has gone into much needed detail with the explanation of pointers and the problems of setting up a computer system eg How to train new users? Who should use the computer? etc. It is a well written manual to data base systems and should be used as a forerunner to all businesses when the question is asked "Should we computerise?". The book does not go into any technical depth and is totally understandable to the non computer mind without being patronising.

Each chapter has an introduction so it is clear what is going to be discussed in that chapter. There is also a short *precis* at the end of each chapter. Although the book is not designed to glorify any data base packages it does suggest which ones may be most useful for your application. The correct system for the social club computerisation is then evaluated in detail so it is easy to see how the method is applied when choosing the correct package.

This book is a must for anyone thinking about computing. If you have already followed the millions by buying a business computer this book should also be read with interest to illustrate the capabilities of such a machine. This book is also one of the few that I can say is totally underpriced. At £2.95 everybody should have one!

ZX81 Chatterbox

Julian Chappel and his ZX81 ride again!

Greetings to all ZX81 owners once again!

I am very pleased to be able to report that following the first appearance of ZX CHATTERBOX in the last issue of ZXC your letters have been flooding in. Both of them! At this rate we shall be completely bogged down with the sheer weight of correspondence by the year two thousand one hundred and ten.

Er... I have a very embarrassing admission to make, so I am writing this extremely quietly in the hope that this column has put in an appearance on these hallowed pages. I already have to apologise for a glaring "boo boo" in the first article.

I'm very, very sorry.

Right... having got the apologies out of the way we can get on with all the good bits. Don't listen to the owners of Spectrums and other lesser machines when they say that all the good points about the ZX81 can be written on the back of a postage stamp in large capital letters. They knoweth not what they are talkething about. After all, we knoweth different, don't we? Even with the advent of machines capable of printing 256 colours in an area the size of a flea's brain and sound good enough to put the London Philharmonic Orchestra to shame... the ZX81 still represents an excellent introduction to computing. It's no secret that the use of home computers is no longer the domain of the whizzkid. Many a whizzdad and whizzmum take an interest these days, but tend to be a little more cautious when entering the world of BASIC binary and bugs than their offspring. Probably because it's their own money they are spending! It stands to reason therefore, that a ZX81 will have 'em programming like a good un in less time that it takes to paint the Severn Bridge with a toothbrush and give a good indication whether or not further delving into the realms of computers seems attractive... all without parting with hundreds of pounds of hard to come by cash. This brings us (rather neatly I think) to the first letter this comes from a newcomer to the ZX81 who was presented with it as a 70th birthday present! Beats woolly socks doesn't it?

(There will be a short delay before this letter due to a second apology. I am very sorry that I didn't tell you what the first apology was all about.)

Now back to the letter.

Dear ZX Chatterbox
As per the Oct/November issue of ZX Computing magazine, I would like details of the S.F.S.C having been a recipient of a ZX81 on my 70th birthday! Not used as much as expected as yet but winter is coming.

I have trouble (not unusual I understand?) with the LOADing program of various lengths both from commercial tapes and my own programs. What occurs is that apparently correct loading takes place as seen by the power meter running to end but with no Report Code, as far as I know I have tried all ways of correction but to no avail.
Yours
W.J. Huggins, Slough

At a time when the ZX81 is regarded as something akin to the Dodo it may seem strange that there are still a substantial number of people acquiring new ones. (Don't be silly! I mean new ZX81s not new Dodos!). This means that there are many ZX81 users who missed the press coverage this little black wedge received during its heyday, and as a result are blissfully unaware of certain facts that us old hands simply take for granted.

Loading

One such fact is that the ZX81 is highly temperamental when it comes to SAVEing and LOADing programs. Another is that swearing at a ZX81 in a particularly obstinate mood has no effect whatsoever. (Except may be making it worse!) Hitting it with a hammer gives the advantage of relieving the user's pent up frustration with the offending machine, but also has the side effect of smashing it into little pieces. Not to be recommended. Here are some less drastic hints and tips towards reliable LOADing.

Setting up the machine

1. The ZX81 was designed for use with an everyday portable mono tape recorder. A dedicated data recorder will be little or no better unless the facility to adjust the azimuth setting is incorporated. A stereo recorder (even a portable one) should be avoided, these may work but reliability will seriously suffer.

2. Clean the heads, rubber pinch wheels and drive spindle of your tape recorder thoroughly and regularly with cleaning fluid. Thoroughly dry and polish all areas with which the fluid comes into contact before re-inserting the tape.

3. Some recorders produce a feedback loop around the ear/mic sockets. Always remove the mic lead when LOADing or the ear lead when SAVEing. Make sure that the ear and mic leads do not cross (or are crossed by) either the mains cable to the tape recorder or power supply transformer or the lead from the power supply. Separate all leads as much as possible.

4. Set the TREBLE control on your recorder to maximum and BASS to minimum (or TONE to high).

5. For reasons best known to Uncle Clive, the ZX81 is less temperamental when the program name is used. Avoid using LOAD "" whenever possible.

The signal

When LOADing, the ZX81 repeats all data read into memory out to the screen, giving those characteristic horizontal lines. This LOADing pattern can therefore give a useful indication of how the LOAD is progressing (but no more than that. It is by no stretch of the imagination an accurate or infallible pointer).

The black horizontal lines should be bold and clearly defined. They will be about 1/2 inches wide (on a portable TV) and the gap between each should be roughly equal to the width of the lines themselves. The width of the spacing will decrease with any increase of volume level. It is the definition of the lines themselves that gives an indication of uncertain LOADing. If they appear thin and straggly or have a snowy effect (i.e. are flecked with a large number of little white dashes) and refuse to become clearly defined no matter what volume level, this is an indication of azimuth misalignment.

The business part of the playback head is a microscopic slot the angle of which in relation to the passing tape is critical. The ZX81 is probably the most sensitive to misalignment of any make of home computer. A good data recorder will have the facility to adjust this angle, usually in the form of a small hole positioned over the head into which an electrician's screwdriver can be inserted. Simply adjust the setting while a LOAD is taking place until the horizontal lines become bold and clearly defined.

Volume setting

Once again the ZX81 can be very sensitive to the volume level used when LOADing. Too low and the LOAD will fail. Too high and the computer can mistake the normal operating noise of the recorder as part of

the program resulting in a bugged copy ending up in memory To find the ideal setting for any given program try the following

1 Start the recorder playing with the volume level at its LOWEST setting

2 Type in LOAD program name followed by N/L Once you are sure the tape will be somewhere within the program itself SLOWLY increase the volume until the characteristic lines appear on the screen This is the lowest possible setting

3 Rewind the tape and LOAD as normal at this volume level

4 If the LOAD fails increase the volume *very slightly* rewind the tape and try again

5 BE PATIENT Don t try to hurry things up by increasing the volume in little jumps By doing this the optimum setting may be missed

6 Once a successful LOAD has been achieved make a note of the volume setting for future reference

7 If problems persist with any particular program it may help to listen to the beginning of the tape through the tape recorder s loudspeaker Stop at a position just before the program starts and start LOADing from there In this way any pops or clicks due to equipment being switched on

or any other inadvertently recorded noise will be avoided There are two main requirements for regular successful LOADing with a ZX81 One is a portable tape recorder that incorporates an azimuth adjustment facility With other computers you can easily get away without one but it is virtually essential for the ZX81 especially when using tapes not recorded on your own machine They are very easy to get hold of these days and are little or no more expensive than an ordinary recorder The second is a little harder to come by I personally cannot find one single shop in the entire length and breadth of England that sells any, but it is probably more important than any other piece of equipment It is patience The patience to experiment carefully and methodically without resorting to swearing or hitting your beloved machine with a hammer Neither of them work

(There now follows a break for a third apology I m very sorry that I *still* haven t told you what the first apology was all about)

Beyond the pale

Before going on to the next letter it is important in the interests of safety to make sure that you are all in a sitting position I would not like to be held responsible for any damage caused should any ZX81 owner faint out of sheer admiration for the bravery and courage of an intrepid member of the S F S C Against all the odds, and everybody s better judgement he went out completely alone onto the streets of London dispensing with the back up of an artillery battery and a couple of infantry divisions Without regard for his personal safety he actually entered various computer retailers walked up to the counter and asked if they stocked any ZX81 titles If this alone does not astound you If you have fainted out of admiration for his courage above and beyond the call of duty then this might just do the trick

He found some

I will let him tell you exactly where I m sure you don t want to listen to any more of my drivel and I d hate to steal his moment of triumph so I hand you over to Simon Godfrey (A round of applause please!)

Dear Galactic Poultry
I d just like to tell you how great I think your Club is and I can t wait for the new games mentioned in — (expletive deleted) — are on the shelves

When I moved to London I decided to go and see what 81 software I could pick up But to my amazement I found a considerable amount available In Ealing (Nr Ealing Broadway to be exact) try Armchair Action , on Oxford Street try McDonald s Hi fi' which can be found near the Virgin Megastore 'Low Price Records Cassettes Software on Tottenham Court Road sells top-class games such as pixel s *Trader* for £1 99 Bug Bytes *Mazogs* at £2 95 and PSS s *Maze Death Race* at £1 99 To reach this shop go down Oxford Street and when you reach Tottenham Court Road go in the left direction facing and after a small walk you will see the shop on the other side of the road Also along Tottenham Court Road is Sonic Foto Centre who sell software and GASP! ZX81 s and RAM packs (The low price shop sells 81s and keyboards for £10!)

In the north of England try Bradleys Records in Sheffield and a really good budget software stall in Chesterfield s Friday open market

I would be very grateful if you publish this letter as it will just help support the best value computer in the world
Yours faithfully
Simon Godfrey, London

So what are you waiting for? Get that hammer you were going to use on your poor unsuspecting ZX81 and attack the old piggy bank instead!

(There now follows a short break I am sorry that there will be no fourth apology due to a shortage of supply)

If you don t live near London or around Sheffield then you will have to resort to writing your own programs Here are a few tips from Jon Rose to help you

Dear Mr Chappell
Something you may be interested in to pass on to other ZX81 users is a few programming tips that I found whilst writing a program called Cabbages and Ants They are all to do with BASIC programming but with sufficient know how can be applied to machine code programs

1 NEVER NEVER use **RND** if you wish to get a random number in ZX81 programs It is not random enough Instead use **PEEK 16438** This is the systems variable SEED and seems to be very random giving 230 different answers when **POKE**d in succession where **RND** could only give fifteen without repetition

2 To save memory use **INT PI** for three **NOT PI** for zero or also **PI PI** Use **CODE** wherever possible Use **VAL** on numbers above 255

3 Want two bytes for some data? The addresses 16417 and 16507 aren t used

4 Want to protect your REM lines?
(i) **POKE 16514,118 POKE 16515,118**
(ii) You might also like to try the code for cursor left (114) This makes the REM line difficult to edit and annoys anyone wanting to cheat at your games
(iii) To cancel the above out poke with 0
Jone Rose Bognor Regis

Well I think I ve apologised enough One can only eat so much humble pie before obesity sets in after all So now the mystery of the first apology will be revealed Do you remember the jolly good program in the last issue? You know ZX YLOPHONE by Paddy Molindrot? Did you try it? Did it work? No

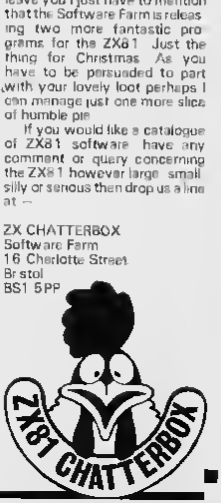
Ah well there is a very good reason for that I forgot to mention that before RUNning this program you have to put your ZX81 into FAST mode It won t work in SLOW

Having already apologised several times you won t get any more sympathy from me even if you have tried for two months to get it to work! Ha! Ha!

On second thoughts before I leave you I just have to mention that the Software Farm is releasing two more fantastic programs for the ZX81 Just the thing for Christmas As you have to be persuaded to part with your lovely loot perhaps I can manage just one more slice of humble pie

If you would like a catalogue of ZX81 software have any comment or query concerning the ZX81 however large small silly or serious then drop us a line at —

ZX CHATTERBOX
Software Farm
16 Charlotte Street
Bristol
BS1 5PP



Into The Archive

The QL's flexible database: by David Nowotnik

Of the four software packages to be supplied free with the QL, the database program, Archive could well be the one most widely used. For while the QL rests in the precarious no man's land at the top end of the home computer market, and bottom of the cut throat business arena, information storage and retrieval will be the major link between the wide ranging band of QL users.

Whether one examines the original versions of Archive supplied to all buyers of the QL prior to February '85, or the upgraded and improved V2.0, the overall conclusion is the same. Archive can provide a superb database system. Its great strength is that it can be tailored exactly to meet the user's requirements, none of the compromises that accompany those ill-fitting off-the-peg packages are necessary.

Archive's strength, however, is also its weakness. When loading Archive into your QL, you haven't got a working database, though you do have the means to create the database. Archive is a high level programming language, not too dissimilar from SuperBasic, which allows a database suite to be created. High level commands such as 'Create', 'Insert', and 'Find' perform the majority of conventional database operations, but it is still left to the user to put together — to program — his/her lists of commands to create the required application for Archive.

Particularly in the business area, users might well be unable or unwilling (for reasons of time) to develop their own suite of procedures which provide the basis of any database application program. Fortunately, there is no copyright restriction on individuals or software houses creating for sale database application software written in Archive's programming language, for use with Archive. While neither Sinclair Research nor Psion have any immediate plans to market Archive application programs, freedom from copyright limitations has allowed other software houses to produce packages (for example, Eldersoft sell a suite of 5 packages for £14.95). In fact Psion have gone a step further to encourage application software. They have available for sale to individuals or companies a 'run time' version of Archive. This program allows copy protection of Archive application software, making Archive a very attractive basis for companies wishing to develop and sell database systems for the QL. In the run time version, the application loads immediately (no need to load Archive, then load the application). There is more RAM available for files, and there should be extra features not available to the standard version of Archive.

By buying one of these application packages, the user is, of course, restricting himself to an off-the-shelf system and so cannot fully benefit from the flexibility which's Archive's main strength. There is the option, for those unwilling to program Archive for themselves to pay a programmer to write software for them. But there is much to be said for trying to write your own software. The Archive programming language is much easier to use than BASIC, and the concepts of the language are adequately covered in the QL's User Guide, as well as a number of other books. The Sunshine Publication by Alison McCallum-Varey called Quill, Easel, Archive and Abacus on the Sinclair QL is one good example of a text book which covers Archive programming in an easy to follow manner.

Your own database

If you are still not convinced that you could write your own database program, then read on. Writing computer programs, even in Archive's simplified programming language, is a matter of applying logic and common sense to solve a problem. Reasonably assuming that everyone is blessed with some abilities to think logically and use common sense, programming Archive should be within anyone's capabilities.

Setting up a database system should involve a preset sequence of tasks, defining exactly what is required, planning a logical sequence of operations to meet the objectives, then writing procedures which carry out these operations. The procedures are tested individually (to iron out bugs), then a linking procedure written to pull together the whole sequence.

To demonstrate Archive's simplicity, here is a simple database application, a name and address file. The list of procedures which make up this file is shown in fig 2. But what may be more relevant to the budding programmer are the processes which were involved in designing the system.

When analysing any potential computer application, the first question that must always be asked is: do I really need a computer to do this? In the case of a name and address file, if all that is required is to look up an address or telephone number, using an address book will always be much simpler (unless the names exceed several thousand!). One justification for a computer file is the need to sort the records in more than one way. I find that I have a remarkable ability for forgetting birthdays, with the result that family and friends are often left disappointed. So this name and address file includes the ability to sort through the records, and identify those families in which a birthday is imminent. The records in the file are in no particular order but this could be achieved with simple modification using Archive's

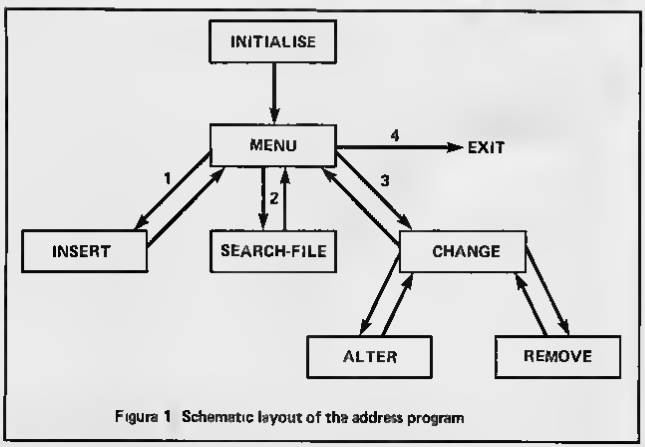


Figure 1 Schematic layout of the address program

powerful language) instead the flexible searching facilities of Archive are used to find relevant records

With the twin needs of the filing system identified the system can then start to be designed Each record should then contain surname christian name(s) the address the telephone number and space to list birthdays This file allows up to three dates per family File creation with Archive is a simple matter of typing in the series of direct instructions starting with the command "create" and ending with "endcreate" It is even simpler with the address program Instead of using a series of direct commands for file creation the name and address program in Fig 2 has a special procedure called "make_file" All you have to do is with the program in place type the direct command "make_file" and a new file will be created on microdrive 2

A simple database program will require a minimum set of operations to be available to the user These are

1 Add another record
2 Search for one or more records
3 Modify or delete a record
4 Exit from the program

These options are available most conveniently through a menu The options are usually numbered and pressing the appropriate number key allows you to inform the computer of your selection

This is how the name and address file works Take a look at Fig 1 to see how it fits together When the program starts it should go into an initialisation procedure which sets up the program ready for use In this case the procedure called initialise sets a 64 character width mode and opens the address film on microdrive 2 ready for read/write operations The program then moves into the menu which prints the options onto the screen After this the program waits for a key press and responds only if keys '1' '2' '3' or '4' are pressed (the 'if' statement(s)) With the appropriate key press (1 to 3) the required procedure is called If '4' is pressed the file is closed and the program is terminated

Options

Fig 1 demonstrates how, with options 1 to 3 the program

Figure 2 Address program listing

```
proc change
  seek
  print at 10,1: "Delete or modify? (d/m)"
  let t$="a"
  while not (t$=" " or t$="m")
    let t$=getkey()
    endwhile
  find a$
  while found()
    display
    sprint
    if t$="d":remove: endif
    if t$="m": alter : endif
    continue
    endwhile
  endproc
proc initialise
  mode 1,6
  open "address"
  endproc
proc make_file
  create "address"
    surname$
    firstname$
    street$
    town$
    county$
    telephone$
    name1$
    birthday1$
    name2$
    birthday2$
    name3$
    birthday3$
    endcreate
  endproc
proc menu
  let s=0
  while s=0
    title
    print at 5,5;"1. Enter new record"
    print at 7,5;"2. Search file"
    print at 9,5;"3. Delete/modify an entry"
    print at 11,5;"4. Exit file"
    print at 13,24;"SELECT 1,2,3, OR 4"
    let s=val(getkey())
    if s=1: insert : endif
    if s=2:search_file: endif
    if s=3:change: endif
    if s=4: close : endif
    if s<>4: let s=0: endif
    endwhile
  endproc
proc remove
  print at 14,5;"Do you want to delete this record? (y/n)"
  yes_or_no
  if p$="y"
    print at 14,5;"          Are you sure? (y/n)          "
    yes_or_no
    if p$="y": delete : cls : return : endif
    else
    print at 14,5;"                                       "
    endif
```

```
    endproc
  proc search_file
    seek
    find a$
    while found()
      display
      sprint
      print at 14,10;"PRESS ANY KEY TO CONTINUE'
      let q$=getkey()
      print at 14,10;"                                    "
      continue
      endwhile
    endproc
  proc seek
    cls ;title
    input at 5,10;"Enter a search word - ";a$
    endproc
  proc start
    initialise
    menu
    endproc
  proc title
    cls
    print at 1,22;"NAME AND ADDRESS FILE"
    endproc
  proc yes_or_no
    let p$="a"
    while not (p$="y" or p$="n")
      let p$=getkey()
      endwhile
    endproc
```


cycles round back to the menu ready for the user to make the next selection. For programming purposes option 1 (enter a new record) is the simplest to incorporate. It uses the Archive command insert. With this in built producedure one or more new records can be entered. Clear instructions at the top of the screen generated by insert makes the process of data entry very simple to do.

The second option in the menu 'Search file' allows you to find any record which has a certain string of characters anywhere in that record. The procedure 'search_file' firstly calls another procedure 'seek' which asks you to enter the string of characters for search purposes. The Archive command find is then called which goes through the file until an exact match is found with the characters you entered. For search purposes upper case letters are the same as lower case. Once a match is found, then the while ... endwhile loop is brought into play in search_file. It displays the record on the screen. The program pauses. let q$ = getkey () while you extract the information you want then the search carries on (the Archive command continue) until more matches are found or the end of the file is reached. At this point (and if no match is found) the procedure ends and the program returns to the menu.

You can search for whatever information you want with the flexible find command. For example if you want a family record displayed enter the surname. If you want all the birthdays in September enter Sep or whatever abbreviation you use for September when inserting records.

The third menu option allows you to alter a record or delete it. Within the 'change' procedure the seek procedure is again called. After all you first have to find the record you want to change. Then you are asked if you want to delete or modify a record to which you should respond 'd' or 'm'. Having made these selections Archive's find command is again used to search through file to find the appropriate record(s).

Once found the record is displayed. If you asked to modify records(s) then the convenient Archive command alter is used to allow you to make changes. Alter works in much the same way as insert and all the instructions needed to make changes are on the screen. If you don't want to make changes simply press F5.

If you requested delete then the remove procedure is called. This asks you twice (to make sure) if the displayed record is the one you wish to remove. If you press 'y' twice then the Archive command delete is called to remove that record from the file.

Going loopy

If you have followed the program description while reading through the program listing how the program works should be reasonably clear, even to the non programmer. Probably the most difficult concept for the novice is the loop — while ... endwhile. This may need a little practise but the QL User Guide covers this rather well so it should cause little problem after some practise.

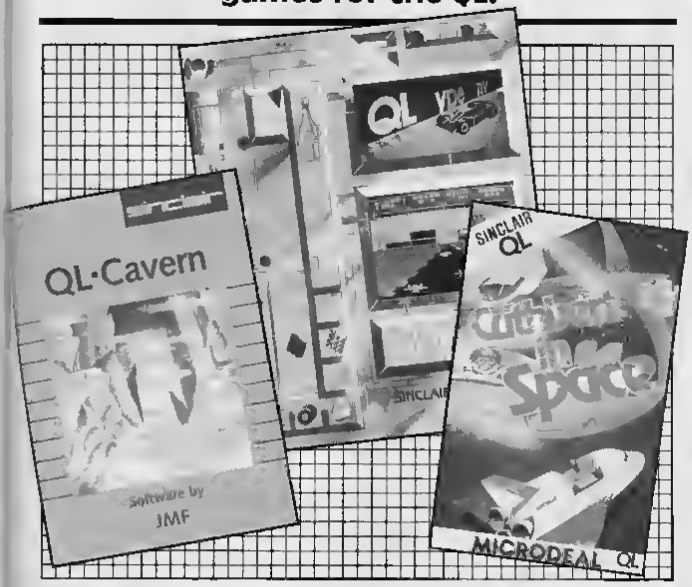
To enter the listing into Archive type in the direct command edit when the ap pears at the base of the screen after booting (loading) Archive. This gives you the word proc. Type n change press ENTER then enter each program line in sequence until you come to endproc in the listing. You don't have to type in endproc as this is provided automatically. Nor do you have to worry about the indentations in program lines as this is also done automatically.

To enter the next procedure press ESC then F3 then n. This allows you to start another procedure. And so carry on in this way until all the listing is in place. Then save it on micro drive 2. Escape from the edit routine by pressing ESC twice. Then type in save and press ENTER. This gives you some quotation marks so place your program name (eg address) in the quotes and press ENTER. The program will be saved on cartridge.

To load the program (the next time you want to use it) type run 'address' after booting Archive. The program will be loaded and run automatically. This autorun facility will search for a procedure called start and one is provided which combines the initialise and menu procedures. Hopefully this short Archive program listing will demonstrate how simple it is to write your own Archive application programs. Archive has the flexibility to be extended from such a simple one file application to quite sophisticated multi file systems.

QL Software

Damien Clay takes a look at some new games for the QL.



QL Hyperdrive English Software £14.95

This is the sort of game where you have to imagine you are a Formula 1 racing car driver and you have to dodge past each car to get into a suitable position (ie 1 5) to get to the next stage. There are five stages and each one is more difficult than the last.

The hi res 3D graphics are very good flicker free and look very realistic with good use of colour. The sound is also very realistic and gives you the feeling that you are actually driving.

It is fairly easy to backup onto disk with the Sinclair utility disk supplied with their drive and if you know a little about programming to another microdrive. There is no backup program on the cartridge itself though.

Playing the game is fairly straightforward all you have are four controls left right accelerate and decelerate using the cursor keys. It is up to you what speed you go but the slower you go the less likely you are to get onto the next stage and the faster you go the harder it is not to crash.

The game is presented very well and displays the instructions on which keys to use it also demonstrates parts of each stage. It comes in a wallet type case with space for another microdrive cartridge. There is a high score routine which displays the highest score but there is no hall of fame.

Overall this is a very good game and is very good value for £14.95 considering that English Software provide a lifetime guarantee on all their games.

Graphics	★★★★★
Addictiveness	★★★
Overall	★★★★

Cuthbert in Space Microdeal £14.95

This is a typical arcade game where you as Cuthbert have been sent on a looting mission in outer space but before leaving each planet you visit you must use your remote shuttle to collect 15 fuel pods. The colour and the graphics are very good and hardly flicker but there is a lack of sound all you get is a few bleeps which does not make it very realistic.

It is very easy to make a backup copy as there is a backup program on the microdrive cartridge.

Playing the game is quite simple though the actual movements of the character are quite fast. It is fairly enjoyable and also reasonably addictive. It is presented very well in a converted cassette case which unfortunately does not hold a backup tape. The program does not give on screen instructions but these are provided on the cassette inlay card.

There is a very simple high score routine but there is no hall of fame which is a pity because you can't put your name up when you get a good score. Overall this game is very good but a bit expensive however with the lack of QL software if you have the money to buy it it's quite enjoyable.

Graphics	★★★★
Addictiveness	★★★
Overall	★★★★

QL Cavern JMF/Sinclair £14.95

This is one of the best arcade games I have seen for the QL and is very well set out. Your objective is to travel the length and breadth of the cavern in order to collect all 396 diamonds.

Throughout your journey you will have to walk crawl swim travel by boat and fly by jetpack. The colour and the graphics are very good and flicker free and the sound though limited is very good.

The game carries a backup program on the microdrive cartridge and instructions are in the little booklet with extra information given onscreen from the start menu.

Play is very enjoyable and addictive some screens are difficult some are complex and some are simple but they are all excellent and very exciting. It is presented in a wallet type case with space for a backup microdrive cartridge. The instructions are clear and easy to understand as well as being brief and well laid out.

There is no high score routine which is a pity because it does tend to spoil the program a bit. Overall it is a very good program and has been well designed and programmed. I personally think it is worth every penny and is well worth adding to your collection.

Graphics	★★★★★
Addictiveness	★★★★
Overall	★★★★★

Spectrum Education

Mike Edmunds grades a couple of packages for those interested or involved with computers and education.

Sitting in a tiny bedroom you look around and gaze with horror at the mess surrounding you. Pieces of paper with hastily written notes, formulae and jottings cover the carpet and overflow from the wastebasket! A cold sweat beads your brow as the enormity of the task facing you finally sinks in . . . . . .

No, it's not the setting for a new adventure . . . merely memories of schooldays with examinations looming! Did you, like many others, find the task of revision a daunting prospect? I certainly did and on more than one occasion I remember rushing to the nearest branch of a certain high street bookseller to search the shelves for those little packets of revision cards!

I doubt that the task of cramming for exams has become any less onerous but at least in this age of the computer, you can test yourself with a whole range of programs which, to a certain degree, allow more flexibility than a textbook with the added benefit of less pieces of paper!

Letts, the producers of those aforementioned little cards, have also branched out into the software scene and have now introduced a computerised version of their Keyfacts for students of O Level, GCE CSE and GCSE Chemistry. At £11.50 the suite of programs is not cheap, but you do get nine programs for your money. The programs have been designed to test your knowledge and to develop your deductive facility.

The suite covers the following areas: Atomic structure and bonding, Periodic tables, Formulae, Chemical deductions, Electrolysis, Apparatus, Acids, bases and salts and Organic Chemistry. The programs come on two tapes in a substantial wallet together with a pamphlet outlining the programs and a suggested list of further study aids (including little packs of cards!).

The programs themselves are equally substantial in terms of what they actually contain, but my overall impression is that the package has a rather bitty approach. This is not to denigrate the actual Chemistry content which seems to cover well the areas concerned, it is merely the way that the whole thing has been presented.

The presentation, I suppose, is not that vital when you are only concerned with the facts and exercises, but it seems rather unfortunate, for example, to go to the lengths of a specially designed title screen only to have it disappear after a few seconds while the rest of the program loads to an empty screen. (loading time is long enough as it is!

Programs

However, on to the programs themselves. The first program, Atomic structure and bonding, is one of several that use a comprehension approach to learning. A passage is presented and the user then has to fill in the missing words, much in the style of the standard cloze procedures. Now this is not necessarily a bad approach, but when half of the words have little relevance to the chemical aspect of the passage I can see no reason to adopt this approach. Words such as 'the' and 'etc' certainly did not test my knowledge of Atomic bonding.

The passage (there is only one) is subject to five levels of difficulty, the harder the level the more words missing. At the hardest level I can see some point, but at the easiest it tests very little except your eyesight (cyan text on white paper!).

The Periodic table program tests your knowledge of the location in the periodic table of some of the more familiar elements. Alternatively, you can select options which require you to apply your understanding of the electronic configuration of atoms.

Formulae and equations requires you to determine reactants and products. You also need to complete equations or organize a selection of chemicals to produce a valid balanced equation. This program is awkward at first as subscript numbers have been assigned to graphics keys, this is rather fiddly, as are some of the other inputs required, but soon grasped.

Chemical deductions tests your overall knowledge of Chemistry by supplying clues about the nature of a substance which has been randomly selected. In Electrolysis a random combination of electrolytes is selected and you are required to identify the ions present, say, which electrode they migrate to, identify the preferred reaction at each electrode and compile the ionic equation for each electrode reaction.

Apparatus puts you back in to the lab selecting the correct apparatus for the preparation of thirteen gases. Your selections are examined and the correct apparatus is drawn. You are then required to provide a balanced equation.

In Acids, bases and salts you have to complete descriptive passages and examine given reactions for validity. You can also see how pH levels change during acid base titrations.

The Organic Chemistry programs are in two parts, one being the missing word passage at the end of which the content is represented diagrammatically. The second requires you to identify isomers, homologues and compounds with similar reactivity. Chemistry being the complex animal that it is I make no apologies for the descriptions above these being necessary to give a fair picture of the programs.

As a package this covers almost everything that the exam student is likely to require. Graphics where applicable are competent and the complete suite goes a long way to making the subject more approachable and enjoyable. Although competent I feel the overall presenta

tion is lacking in some areas There is also a bug which causes one program to crash and obviously needs sorting out!

This is not a cheap package and there are several programs available at present from other companies which do the job equally well but if you have a need for a revision package then this could go very well with those little packs of cards!

Software directory

Now to software of a different kind that contained as entries in a Software Directory from Macdonald and Evans Ltd The directory is arranged according to subject areas and is designed to provide all types of educational establishment primary secondary and beyond — with up to date and concise information on educational software currently available

The entries appear alphabetically by software title and provide a guide to the age group where possible Each entry indicates the machine which the software runs on and the form it takes Prices are included though purchasers are advised to check details with the suppliers prior to purchase The whole range of curriculum subjects is covered and the two largest sections Mathematics and English are divided into broad age groups As well as subject software the directory also gives an extensive bibliography of educational computing references together with lists of periodicals computer organisations computers for Education and a list of software suppliers whose software is included within the directory

The Directory is certainly comprehensive but as with similar books covering other areas it suffers in that it seeks to embrace too large an area The age range beginners to secondary and beyond is just too large to be of use to specific users say in a Primary School who would look to other sources of information The major drawback with something of this nature is that like micros themselves as soon as it is released it is out of date There are notable omissions in certain subject areas software that has been widely reviewed elsewhere but then again if they don t send details

These omissions illustrate the speed with which such publications become dated Many programs remain a mystery there is little or nothing in the directory to indicate their educational nature I know what Dar and Logo do but there are no details within the book for those who do not Similarly several of the organisations listed are not adequately described

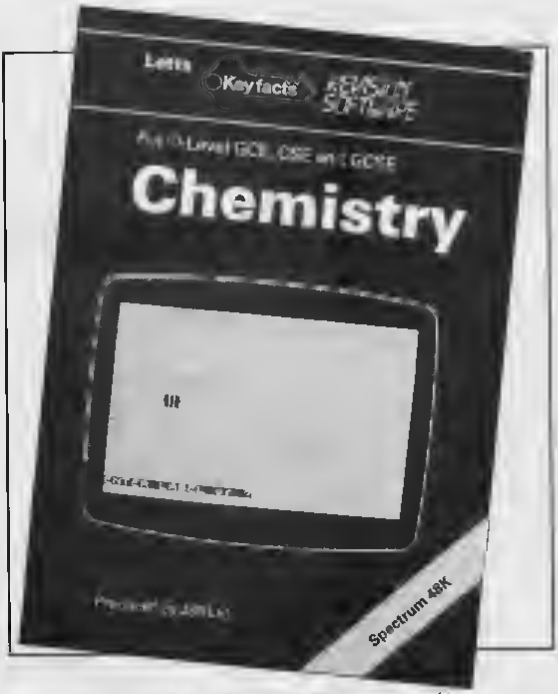
This can hardly be called a fair review of such an extensive book that would require much more space than is available here I would suggest that if you have a need for a software reference book then this is the best that I have currently seen though I personally am currently using some excellent programs that are not even mentioned here

The Directory is certainly very comprehensive and informative (it is intended to update it at appropriate intervals) and overall this is a valiant effort to make the educational field aware of the range of software currently available but for me it attempts too many areas for too many machines all at once!

That s all for now next issue I ll be looking at some adventures especially for children

Chemistry
Letts Keyfacts Revision Software
Spectrum 48K £11 50
Charles Letts & Co Diary House Borough Rd London SE1 1DW

The M & E Educational Software Directory
J Arthur & T Russell
Macdonald and Evans Ltd
Estover Plymouth PL6 7PZ
(covers most micros) £12 50



Safe Save Booster

Anthony Marlow from Cheshire has sent in a useful little device for helping with SAVEing programs

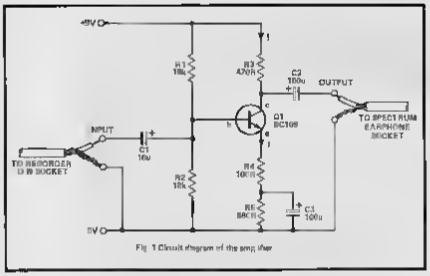


Fig 1 Circuit diagram of the amplifier

If you're fed up with starting to SAVE a program on cassette and only then realising that you've forgotten to disconnect the earphone plug or with exerting a considerable force in pulling out and pushing back in the power supply plug to provide a system reset, then this simple inexpensive hardware project may be what you're looking for. None of the components used is expensive or hard to get hold of and even when put in a plastic case will only cost about £3 50. This is much less than some commercially available designs which just comprise an on/off switch for £5 00. You don't have to be an electronics boffin to build it although you will need to have access to a fine-tipped soldering iron.

Feedback

The need to remove the earphone plug while saving a program stems from the fact that most domestic portable cassette recorders feed the signal that is being recorded to the earphone socket. If the plug is not removed, then this signal is returned to the Spectrum and interferes with the signal being sent from the Spectrum to the cassette recorder. So a vicious circle is created which prevents the correct signal being recorded. Obviously one could install a switch in the earphone line but the result is no more convenient than having to remove and reinsert the earphone plug. However, a number of cassette recorders also possess a 5 pin D.I.N. input/output socket which is normally used for recording between two cassette recorders. A similar feedback problem could also exist between two cassette recorders and for this reason the output from the DIN socket is normally switched off inside the cassette recorder when put into RECORD mode. Thus if use could be made of this output rather than the earphone socket, our vicious circle will be broken automatically without us having to unplug or switch anything unlike many commercial devices. On most recorders however the DIN socket output is not sufficiently powerful to drive the Spectrum input when loading a program. To overcome this problem the simple transistor amplifier stage (Figure 1) was designed and built. This amplifies the signal by nearly five times, so that the output signal is capable of driving the input circuitry of the Spectrum. Note, however, that on some machines the DIN socket output is independent of the volume and tone controls.

How It Works

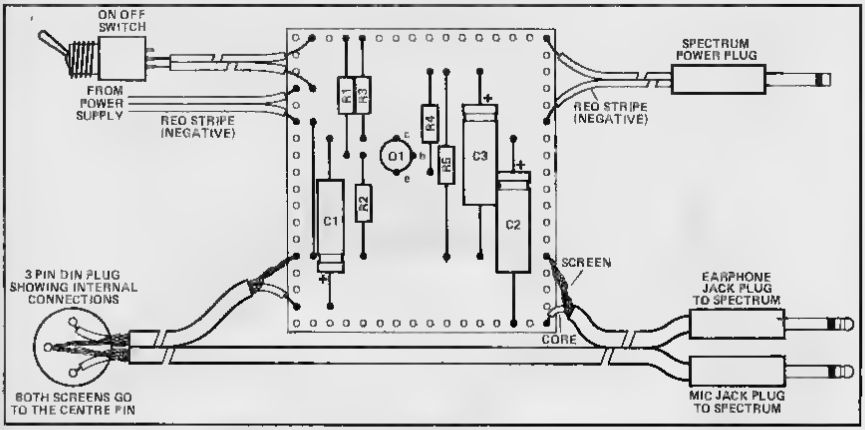
To fully understand how the circuit works would require a detailed knowledge of semiconductor theory. However, a brief description of what a transistor does will give some insight into how the circuit works. Basically, a transistor (TR1 in our case) consists of two pieces of an impure semiconductor material (usually silicon) with a thin slice of the same semiconductor (but with a different impurity) in between them. The two outer pieces are called the 'emitter' and 'collector', and the thin slice in the middle is called the 'base'. These are labelled as e, c and b respectively on the diagram (Figure 2a).

One of the properties of a transistor is that a small variation in voltage applied between the base and emitter (the signal) can cause a large variation in the current I which flows from the collector to the emitter. Thus, if a resistor is placed in the collector lead (R3) then by Ohm's Law (V = IR) the voltage at the collector will be proportional to this changing current, the precise value being determined by the value of R3. By choosing appropriate component values in the circuit, any desired amplification may be achieved.

Before the transistor can do anything, however, certain static d.c. conditions have to be set up. R1 and R2 form a potential divider which sets the static base voltage. Because the values of R1 and R2 are high, the best voltage can still be altered by a small amount when a signal is applied to it via capacitor C1. The static base voltage in turn sets the static emitter voltage. Given this, resistors R3 and R4 set the necessary standing current which flows between the emitter and 0V. The gain or amplification of the amplifier is set by the ratio R3/R4. Capacitors C1 and C2 allow the signals to pass through but prevent the standing voltages on the transistor getting through and upsetting the d.c. conditions in the recorder or Spectrum. The circuit takes its power from the Spectrum power supply. Since this involves cutting the wire from the power supply, a switch was added at the same time so that power could be switched off and on to effect a system reset.

Construction

The prototype was built on a small piece of 0.1" matrix Veroboard available from most electronic component suppliers. The actual size required is 16 holes by 16 holes with the copper strips running along the shorter dimension. This can be cut from a larger piece. The component layout and connections are shown in (Figure 2a). Begin by fitting the resistors on the plain side of the board. Pass the leads through the appropriate holes and solder them to the copper strips on the other side. Use only fine multicored solder *and make sure the solder does not bridge the tracks*. Trim the leads close to the soldered joint. Next, fit the capacitor and transistor in the same way, taking great care that they are inserted the right way round (the capacitors will be marked as being positive or negative at one end and the tag on the transistor case is adjacent to the emitter). Now take a length of stereo screened cable (about half a metre) and carefully cut one wire about eight inches from one end, leaving the other wire intact. Strip the outer insulation off both cut ends and seperate the screen wires from the central core, then remove about a



quarter of an inch of insulation from the core. Solder the two cut ends to the board as shown in (Figure 2a) with the shorter length to the right. Two 3.5mm jack plugs are now fitted to the shorter length of the stereo cable. Separate the cable by a few inches before fitting the plugs and remember to thread each plug cap on the respective half of the cable *before* soldering the wire to the plug!

In each plug the cable screen goes to the outer connection and the core to the central contact. Grey and black jack plugs can be obtained to match those on the original lead. The DIN plug is next to be wired up. Only a three pin plug is required even though the cassette recorder will probably have five or more pins. For details of the connections refer to (Figure 2a). Next cut the power supply lead about five inches from the Spectrum plug. Strip the ends of the wires and connect them to the matrix board as shown in (Figure 2a). There is a red stripe down one of the two wires and strangely, this was found to be the NEGATIVE side of the supply. Incidentally, it seems to be quite common for one of the wires to break inside the moulded on plug due to flexing of the wire as the plug is pulled out and pushed in. Rather than sending the whole power supply unit off for a costly repair the plug can be cut off and replaced with another. It is just a few voltage d.c. connector widely available for just a few pence. The negative (red) wire connects to the inside of the plug and the black to the outer part.

The only remaining connection to make is that between the board and the on/off switch. A short length can be removed from the power supply lead when cut for the purpose. Any single pole single throw (S.P.S.T.) switch can be used. Just connect the wire as shown in (Figure 2b). The orientation of the wire is not important. Finally the prototype was installed in a small plastic box for neatness.

The Circuit in Use

Provided the circuit has been built correctly it should work first time. Another jack plug will be needed for the cassette earphone socket in order to switch off the loudspeaker when loading a program. Alternatively if an earphone is plugged in then it will be possible to hear a program being saved. If the circuit does not work it is likely that a mistake has been made in the construction. Make sure there are no solder bridges across the tracks and that the capacitors and transistor are inserted correctly. The circuit has been found to slightly improve the ability to load some programs but cannot improve what isn't there. Most loading problems are due to sub standard recordings and badly misaligned tape heads. It will work with the new turbo load method now used by many companies.

List of Parts

2 × 1.6K ¼W Resistor (R1, R2)
1 × 470Ω ¼W Resistor (R3)
1 × 100Ω ¼W Resistor (R4)
1 × 680Ω ¼W Resistor (R5)
1 × 10μF 16V Electrolytic Capacitor (C1)
2 × 100μF 16V Electrolytic Capacitor (C2, C3)
1 × BC108 Transistor (TR1)
1 × S.P.S.T. Switch
1 × 3 pin DIN plug
3 × 3.5mm jack plugs
1m Stereo Screened cable
0.1" Veroboard as required (see article)
Box as required

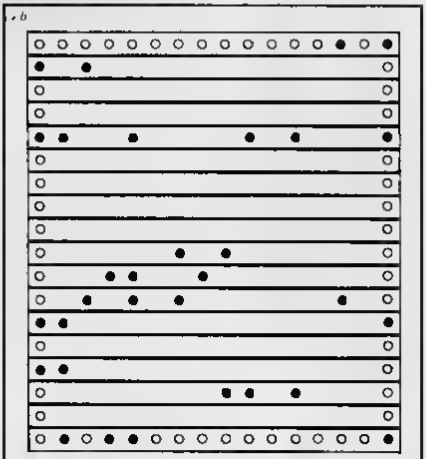
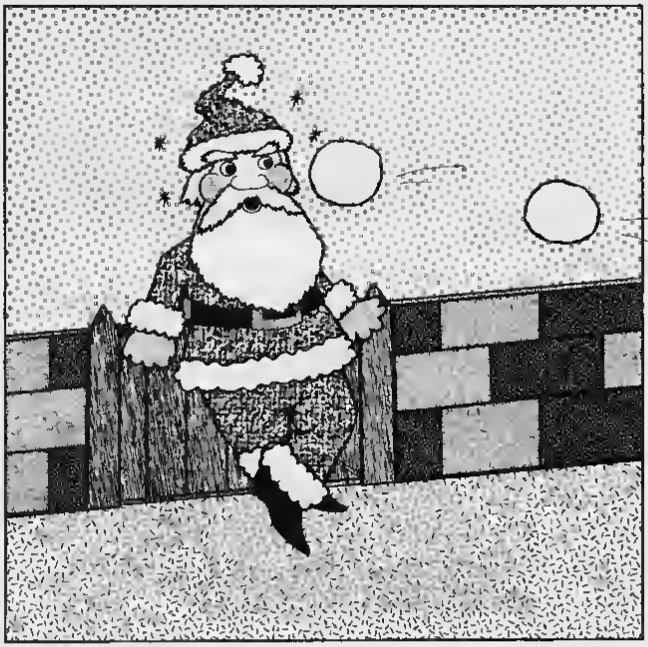


Fig 2 Construction, showing layout of components and wiring (above) and solder connections on the underside of the board (below)

Derek Mearns shows us what poor Santa has to put up with every Christmas.



It's Christmas time again and Santa has deliberately left the next house on his round until last. It is reputed to be the worst house any Father Christmas has ever had to deliver to. Even the normally compassionate Easter Bunny curses its existence! Still, deliver he must and so he sets out on the treacherous journey across the snowy artic.

The game has five stages each requiring a different skill to complete. After the completion of each stage you progress onto the next. After finishing all five stages at December 1985 you progress to Christmas the next year and then to 1987, 1988 and so on with each year being more difficult than the previous one.

Variables

a b	reserved for READing DATA
e	stage
f g,j	reserved for FOR NEXT loops
h	high score
l	number of lives remaining
p	print positions for the obstacles on stage one
r	reserved for RANDom numbers
s	score
t	various including time on stage 3 and total of key presses on stage 5
u	Flag for whether or not Santa is Up in the air on stage 4
x	X Co ordinate of Santa
y	year
c$	width of roof and Chimney on stage 2
h$	name of the high scorer (maximum 10 letters)
k$	contains the user-defined keys
r$	reserved for INKEY$

Program Breakdown

A brief program is included in the form of REM statements within the program but for those of you who are interested what follows is a more detailed program including notes on what certain special commands (e g the POKEs) do

15	GOSUBs the UDGs Originally these were part of the main program but were changed to a subroutine so that they were set up to be printed in the instructions
20	The POKE sets the computer in CAPS LOCK mode
25	Sets up variables that should not be reset at the start of a new game
30	Initialises variables that need defining at the beginning of each new game
52	GOSUBs the main instructions
60 99	Asks for the User Defined keys Enter can be used as a key but will present problems in lines 9300 9550
900 995	Sets up variables needed for stage one including 910 P is set up to hold the print positions and types of obstacles 950 GOSUBs the NEXT STAGE and brief instruction reminders subroutine 990 This POKE stops the computer asking scroll ? at line 1070 995 GOSUBs the traffic light countdown subroutine Both this and the subroutine activated at line 950 occur at the start of each stage
1000 1070	Contains the main body of Stage 1
1900 1980	Checks for INKEY$ and detects collisions
2000	Gives you a bonus for completing Stage 1 and GOSUBs the congratulations message (also activated each stage)
2020 2040	Determines the width of the roof and sets up the screen
2100 2220	Contains the Stage 2 action
2510 2590	Prints the chimney and determines the speed for Stage 3
2600 2800	Stage 3 proper
3010 3090	Initialises screen and variables for Stage 4
3100 3130	Stage 4 routine when there is no snowball
3200 3240	Ditto for when there is a snowball present
3300 3330	Performs Santa s leap over the Christmas tree
3600 3617	Sets up the variables and screen for the next stage Note that the INK colour is set to 5 (cyan) yet the houses are printed in yellow so that their ATTRibutes are different Thus a collision with the houses can be detected using the ATTR command in line 372
3620 3800	Contains the main part of Stage 5

From there on the REM statements serve just as well as a description would so you can go through them if you need a breakdown of the latter parts of the program —$ mainly subroutines

```
  1 REM ***********************
        *Underlined characters*
        *are entered in       *
        *GRAPHICS mode.       *
        ***********************
 10 REM INITIALISE SREEN AND
        SOME VARIABLES
 22 GO SUB 101
 25 LET H=0: DIM H$(10)
 30 LET Y=1: DIM K$(4): LET L=5
 LET S=0
 40 BRIGHT 0: PAPER 0: BORDER 0
: CLS : POKE 23658,8
 50 INK 6: PRINT AT 0,2; BRIGHT
 1;"SANTA'S CHRISTMAS NIGHTMARE'
";TAB 2;"
"
 52 GO SUB 9200
 55 REM DEFINE KEYS
 57 INK 6: PRINT AT 0,2; BRIGHT
 1;"SANTA'S CHRISTMAS NIGHTMARE'
";TAB 2;"
"
 60 INK 5: PRINT AT 5,0;"WHICH
KEYS WOULD YOU LIKE ?""""LEFT:"
"""RIGHT:""""UP:""""DOWN:"
 70 FOR F=1 TO 4: PRINT AT F*2+
6,10; FLASH 1;"?"
 80 LET R$=INKEY$: IF R$<>"" TH
EN  GO TO 80
 90 LET R$=INKEY$: IF R$="" THE
N  GO TO 90
 95 BEEP .05,20: PRINT AT F*2+6
,10;R$: LET K$(F)=R$: NEXT F
 97 FOR F=1 TO 4: FOR G=1 TO 4:
 IF F=G THEN  NEXT G: NEXT F: GO
 TO 100
 98 IF K$(F)=K$(G) THEN  CLS :
GO TO 57
 99 NEXT G: NEXT F
 100 GO TO 200
 101 REM DEFINE GRAPHICS
 103 RESTORE 100
 105 FOR G=144 TO 159: FOR F=0 T
O 7: READ A: POKE USR CHR$ G+F,A
: NEXT F: NEXT G
 110 DATA 28,28,8,62,8,20,20,20
 120 DATA 56,124,214,186,124,214
,146,16,24,52,82,255,169,255,153
,255,56,120,44,46,42,58,40,104,2
4,36,24,36,66,66,36,24
 130 DATA 18,63,254,252,124,62,1
27,118
 140 DATA 30,30,76,111,236,255,2
55,126,0,1,1,3,255,252,68,68
 150 DATA 1,3,7,15,31,63,127,255
,128,192,224,240,248,252,254,255
 160 DATA 102,102,102,102,255,25
5,255,255
 170 DATA 0,0,64,96,224,255,255,
126,28,62,127,127,127,73,42,28
 180 DATA 255,32,32,255,255,2,2,
255
 190 DATA 60,66,129,129,129,129,
66,60,60,126,255,255,255,255,126
,60
```

```
 199 RETURN
 900 REM SCREEN 1
 902 BRIGHT 0: PAPER 7: BORDER 7
: CLS
 905 INK 1: PRINT AT 11,10;"PLEA
SE WAIT"
 910 DIM P(Y*79,2): FOR F=1 TO Y
*79: LET P(F,1)=INT (RND*30)+1:
LET P(F,2)=INT (RND*31+146: NEXT
 F
 920 INK 1: LET N=0: LET E=1: LE
T X=15
 950 GO SUB 9800: INK 2: CLS
 990 POKE 23692,255
 995 GO SUB 9900
1000 FOR F=1 TO 100: LET S=S+1
1050 PRINT AT 0,X;"B"
1060 IF F<80 THEN  FOR G=1 TO Y:
 LET N=N+1: PRINT AT 21,P(N,1);
INK 0;CHR$ P(N,2): NEXT G: PRINT
 AT 21,0; INK 4;"E";AT 21,31;"B"
1065 GO SUB 1900
1070 PRINT AT 21,0; INK 0; OVER
1,,,,: NEXT F: GO TO 2000
1900 LET R$=INKEY$: FOR G=1 TO 4
: IF K$(G)=R$ THEN  GO TO G*20+1
900
1910 NEXT G: GO TO 1960
1920 IF ATTR (1,X-1)<>58 THEN  P
RINT AT 1,X-1; INK 2;"E";AT 0,X;
" ": INK 1: GO SUB 9000: GO TO 9
00
1930 LET X=X-1: IF X=0 THEN  LET
 X=X+1: GO TO 1960
1935 RETURN
1940 IF ATTR (1,X+1)<>58 THEN  P
RINT AT 1,X+1; INK 2;"E";AT 0,X;
" ": INK 1: GO SUB 9000: GO TO 9
00
1950 LET X=X+1: IF X=31 THEN  LE
T X=X-1: GO TO 1960
1955 RETURN
1960 IF ATTR (1,X)<>58 THEN  PRI
NT AT 1,X; INK 2;"E";AT 0,X;" ":
 INK 1: GO SUB 9000: GO TO 900
1980 RETURN
2000 INK 1: LET S=S+50*L: GO SUB
 9820
2005 PAPER 0: BORDER 0: CLS
2010 REM STAGE 2
2020 INK 5: LET E=2: GO SUB 9800
: INK 6: LET W=10-Y: IF W<1 THEN
  LET W=1
2030 LET C$="[illegible]"( TO W)
2040 PRINT AT 15,16;"L";TAB 16;"
B"
2100 PRINT AT 17,15-W/2;"J";C$;"
```

```
J"  FOR F=1 TO 21: PRINT AT F,1
5-W/2;C$;"[illegible]": NEXT F
2110 GO SUB 9900: FOR F=0 TO 29:
 PRINT AT 0,F; INK 2;"_"; INK 6
;"H": IF INKEY$=K$(4) THEN  GO T
O 2200
2120 NEXT F: INK 5: GO SUB 9000:
 GO TO 2010
2200 LET X=F+1: PRINT AT 0,X; IN
K 2;"L"; INK 6;"H": INK 2: FOR F
=2 TO 13: PRINT AT F-1,X;" ";AT
F,X;"U";AT F+1,X;"B": FOR G=1 TO
 40: NEXT G: NEXT F: IF X=16 THE
N  LET S=S+100: GO TO 2250
2210 FOR F=14 TO 15: PRINT AT F-
1,X;" ";AT F,X;"U";AT F+1,X;"B":
 FOR G=1 TO 40: NEXT G: NEXT F
2220 IF X<16-(W/2+1) OR X>16+W/2
 THEN  FOR F=16 TO 20: PRINT AT
F-1,X;" ";AT F,X;"U";AT F+1,X;"B
": FOR G=1 TO 40: NEXT G: NEXT F
: INK 5: GO SUB 9000: GO TO 2010
2250 CLS
2300 INK 5: LET S=S+50+20*L: GO
SUB 9820
2500 REM STAGE 3
2510 CLS : LET E=3: INK 5: GO SU
B 9800: INK 6: FOR F=5 TO 21: PR
INT AT F,12;"N";TAB 19;"N": NEXT
 F: PRINT AT 4,12;"NNNNNNNN": FO
R F=0 TO 3: PRINT AT F,13;"NN";T
AB 17;"NN": NEXT F
```

```
2520 PRINT AT 21,0;"NNNNNNNNNNNN
NNNN";AT 6,13;"NNN";AT 20,12;"
N"
2530 LET X=15: PRINT AT 5,15; IN
K 2;"A"
2540 LET W=10-Y: IF W<1 THEN  LE
T W=1
2550 LET W=W/2
2590 GO SUB 9900
2600 INK 5: FOR F=21 TO 6 STEP -
1: FOR G=1 TO W*4: NEXT G: PRINT
 AT F,16;"▬▬": IF F<21 THEN  PR
INT AT F+1,16;"    "
2610 LET R$=INKEY$: IF R$=K$(2)
THEN  GO TO 2700
2615 FOR G=1 TO W*4: NEXT G: PRI
NT AT F,16;"▬▬": IF INKEY$=K$(2
) THEN  GO TO 2700
2620 NEXT F: FOR F=6 TO 21: FOR
G=1 TO W*4: NEXT G: PRINT AT F-1
,16;"    ";AT F,16;"▬▬": IF INKE
Y$=K$(2) THEN  GO TO 2700
2625 FOR G=1 TO W*4: NEXT G: IF
F<21 THEN  PRINT AT F,16;"▬▬"
2627 IF INKEY$=K$(2) THEN  GO TO
 2700
2630 NEXT F
2640 PRINT AT 17,0;"TIME:": PRIN
T AT 20,12;"    ": FOR T=20 TO 0
STEP -1: PRINT AT 17,5;T;" ": NE
XT T: FOR F=1 TO 40: NEXT F: INK
 5: GO SUB 9000: GO TO 2500
2650 FOR F=6 TO 21: FOR G=1 TO W
*4: NEXT G: PRINT AT F,16;"▬▬";
AT F-1,16; INK 2;"A": IF INKEY$=
K$(1) THEN  GO TO 2690
2658 PRINT AT F-1,16; INK 2;"A
": FOR G=1 TO W*4: NEXT G: IF F<
21 THEN  PRINT AT F,16;"▬▬"
2659 IF INKEY$=K$(1) THEN  GO TO
 2690
2660 PRINT AT F-1,16;"    ": NEXT
 F: PRINT AT F-2,16; INK 2;"A":
PRINT AT 17,0;"TIME:": PRINT AT
20,14;" ": FOR T=20 TO 0 STEP -1
: PRINT AT 17,5;T;" ": IF INKEY$
=K$(1) THEN  GO TO 2800
```

```
2670 NEXT T: FOR F=1 TO 40: NEXT
 F: INK 5: GO SUB 9000
2690 PRINT AT F-1,16;"    ";AT F,
16;"▬▬": FOR F=F-1 TO 20: PRINT
 AT F-1,15;" ";AT F,15; INK 2;"A
": FOR G=1 TO 40: NEXT G: NEXT F
: PRINT AT 20,15; INK 2;"E": FOR
 F=1 TO 40: NEXT F: INK 5: GO SU
B 9000: GO TO 2500
2700 LET X=16: PRINT AT 5,15;" "
: IF F=6 THEN  GO TO 2650
2710 IF F>6 THEN  FOR F=6 TO F-1
: PRINT AT F-1,16;" ";AT F,16; I
NK 2;"A": FOR G=1 TO 40: NEXT G:
 NEXT F: PRINT AT F-1,16; INK 2;
"E": FOR F=1 TO 40: NEXT F: INK
5: GO SUB 9000: GO TO 2500
2800 FOR F=15 TO 0 STEP -1: PRIN
T AT 20,F; INK 2;"A ": FOR G=1 T
O 20: NEXT G: NEXT F
2900 INK 5: LET S=S+50+(T+101*L:
 GO SUB 9820
3000 REM STAGE 4
3010 LET E=4: INK 5: GO SUB 9800
3020 INK 4: FOR F=101 TO 61 STEP
 -20: FOR G=1 TO 30: PLOT 30-G/2
,F-G: DRAW G,0: NEXT G: NEXT F:
INK 2: FOR F=26 TO 34: PLOT F,16
. DRAW 0,15: NEXT F
3030 INK 5: FOR F=0 TO 15: PLOT
20 F/2,F: DRAW F+20,0: NEXT F
3040 LET W=10-Y: LET W=W/3: IF W
<1 THEN  LET W=1
3090 LET X=36: INK 7: GO SUB 990
0
3100 PRINT AT 21,X; INK 2;"A "
3110 FOR F=1 TO W*4: NEXT F: IF
INKEY$=K$(1) THEN  LET X=X-1: LE
T S=S+1: IF X=6 THEN  GO TO 3300
3120 IF RND<.15 AND X>11 THEN  L
ET U=0: PRINT AT 21,X; INK 2;"A
" GO TO 3200
3130 GO TO 3100
3200 FOR F=7 TO 31: FOR G=1 TO W
*4: NEXT G: LET S=S+1: PRINT AT
21,F-1;" E": IF F=X AND U=0 THEN
  PRINT AT 21,X; INK 2;"E": FOR
F=1 TO 20: NEXT F: INK 5: GO SUB
 9000: GO TO 3090
3210 IF INKEY$=K$(3) AND U=0 THE
N  LET U=1: LET T=0: PRINT AT 21
,X;" "
3220 IF U=1 THEN  LET T=T+1: IF
T=5 THEN  LET U=0: PRINT AT 20,X
," "
3230 PRINT AT 21-U,X; INK 2;"A":
 IF F=X AND U=0 THEN  PRINT AT 2
```

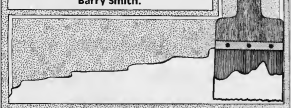
```
1,X; INK 2;"E": FOR F=1 TO 20: N
EXT F: INK 5: GO SUB 9000: GO TO
 3000
3240 NEXT F: LET U=0: PRINT AT 2
1,31;" ";AT 21,X; INK 2;"A";AT 2
0,X;" ": LET S=S+5: GO TO 3100
3300 PRINT AT 21,7;" ": FOR F=20
 TO 10 STEP -1: PRINT AT F,6; IN
K 2;"B";AT F+1,6;" ": FOR G=1 TO
 10: NEXT G: NEXT F
3310 PRINT AT 10,6;" ": RESTORE
3320: FOR F=1 TO 5: READ A,B: PR
INT AT A,B; INK 2;"A": FOR G=1 T
O 10: NEXT G: PRINT AT A,B;" ":
NEXT F
3320 DATA 9,5,8,4,7,3,8,2,9,1
3330 FOR F=10 TO 21: PRINT AT F,
0; INK 2;"B";AT F-1,0;" ": FOR G
=1 TO 10: NEXT G: NEXT F
3340 FOR F=1 TO 200: NEXT F: INK
 5: LET S=S+50: GO SUB 9820
3500 REM STAGE 5
3510 LET E=5: INK 5: GO SUB 9800
3600 PRINT AT 20,0; PAPER 7,,,,:
 FOR G=0 TO 5: FOR F=6+G TO 19:
PRINT AT F,G; INK 6;"■";AT F,31-
G;"■": NEXT F: PRINT AT G+5,G; I
NK 6;"J";AT G+5,31-G;"I": NEXT G
: PRINT AT 6,2; INK 6;"K";AT 7,2
;"■";AT 6,29;"K";AT 7,29;"■"
3610 PRINT AT 19,15; INK 2;"G";
INK 6;"H": LET T=0
3615 GO SUB 9900: IF INKEY$=K$(3
) THEN  PRINT AT 11,11;"HANDS OF
F!": FOR F=1 TO 100: NEXT F: PRI
NT AT 11,11;"            ": GO TO
3615
3617 PRINT AT 2,2; INK 7;"TIME:5
00"
3620 FOR F=500 TO 0 STEP -1
3625 PRINT AT 2,7; INK 7;F;" "
3630 IF INKEY$=K$(3) THEN  LET T
=T+1: GO TO 3650
3640 NEXT F: GO TO 3700
3650 IF INKEY$<>"" THEN  LET F=F
-1: PRINT AT 2,7; INK 7;F;" ": I
F F>0 THEN  GO TO 3650
3655 IF F<1 THEN  GO TO 3700
3660 NEXT F
3700 LET T=T*2: LET T=T-15*Y: LE
T T=T-36: LET T=19-T: IF T<0 THE
N  LET T=0
3710 FOR F=18 TO T STEP -1: PRIN
T AT F,15; INK 2;"G"; INK 6;"H";
AT F+1,15;"  ": FOR G=1 TO 40: N
EXT G: LET S=S+20: NEXT F
3720 FOR F=15 TO 29: FOR G=1 TO
```

```
40: NEXT G: PRINT AT T,F; INK 2;
" C"; INK 6;"H": IF ATTR (T,F+3)
=6 THEN  FOR G=1 TO 40: NEXT G:
GO TO 3750
3730 NEXT F: GO TO 3800
3750 INK 2: PRINT AT T,F+1;" C":
 FOR G=1 TO 40: NEXT G: PRINT AT
 T,F+2;"B": FOR J=1 TO 40: NEXT
J: PRINT AT 19,F+2;"E": INK 5: G
O SUB 9000: GO TO 3500
3800 LET S=S+200: GO SUB 9820
4000 REM NEXT YEAR
4010 LET Y=Y+1
4020 CLS : PRINT AT 6,0;"WELL DO
NE - YEAR ";Y+1983;" COMPLETED"
;AT 12,0;"YOU NOW PROGRESS TO YE
AR ";Y+1984"WHICH, OBVIOUSLY, I
S HARDER."
4030 FOR F=1 TO 200: NEXT F: GO
TO 900
9000 REM YOU LOSE A LIFE
9010 LET L=L-1: FOR F=1 TO 100:
NEXT F: CLS : PRINT AT 6,2;"BAD
LUCK ! - YOU LOST A LIFE";AT 12,
10;L;" LIVES LEFT"
9015 FOR F=15 TO 0 STEP -1: BEEP
 .1,F: NEXT F
9020 FOR F=1 TO 200: NEXT F: CLS
 : IF L=0 THEN  GO TO 9100
9030 INK 2: RETURN
9100 PRINT AT 4,0;"YOU REACHED Y
EAR ";Y+1984;" (STAGE ";E;")";AT
 8,0;"YOU SCORED ";S
9110 IF S>=H THEN  PRINT AT 12,0
;"YOU BEAT THE HIGH SCORE
  THE HIGH SCORE IS NOW ";S: LET
 H=S: PRINT "PLEASE ENTER YOUR N
AME": INPUT  LINE H$
9120 IF S<H THEN  PRINT AT 12,0;
"THE HIGH SCORE REMAINS ";H'"BY
";H$
9130 PRINT AT 19,0;"PRESS ANY KE
Y TO PLAY AGAIN"
9140 IF INKEY$="" TNEN  GO TO 91
40
9150 RESTORE : CLS : GO TO 30
9210 BRIGHT 1: INK 5: PRINT '"Yo
u play the part of Santa ("; INK
 2;"A"; INK 5;")"'"delivering pr
```

```
esents to the last house on his
round."
9220 PRINT '"STAGE 1: Use the le
ft and right keys to guide Santa
 through the snow avoiding the t
rees ("; INK 4;"E"; INK 5;"), th
eigloos ("; INK 7;"O"; INK 5;"),
 the penguins ("; INK 7;"D"; INK
 5;") andthe snowmen ("; INK 7;"
E"; INK 5;")."
9230 PRINT '"STAGE 2: Press the
 down key to  parachute from your
 sleigh ("; INK 2;"O"; INK 6;"H"
; INK 5;") down onto the roof. L
and on the chimney ("; INK 6;"K"
; INK 5;") for a points bonus."
9235 GO SUB 9700
9240 PRINT AT 3,0;"STAGE 3: Now
you are inside the chimney and m
ust get to the      bottom using
the lift (▬).      Press the rig
ht key to step ontothe lift and,
 when the brick ("; INK 6;"N"; I
NK 5;")at the bottom disappears,
 press the right key before your
 time  limit runs out."
9250 PRINT '"STAGE 4: Cross the
floor to the Christmas tree usin
g the left   key. When a snowbal
l ("; INK 7;"P"; INK 5;") appear
swait until it is near you and
 use the up key to jump over it.
 Wait until the snowball leaves
 the screen and then continue
 towards the Christmas tree."
9255 GO SUB 9700
9260 PRINT AT 3,0;"STAGE 5: Pres
s the up key as     many times as
 you can while the clock ticks a
way. The more timesyou press it
 the more height thesleigh ("; IN
K 2;"O"; INK 6;"H"; INK 5;") wil
l achieve. You    must get high e
nough to clear    the houses othe
rwise you'll      crash."
9270 PRINT '"At the beginning of
 each screen you will be given a
 brief        reminder of these i
nstructions  and then traffic li
ghts will    count you down to t
he start.    When the green ligh
t ("; INK 4;"O"; INK 5;") lights
 up ("; INK 4;"P"; INK 5;") the
screen will start."
9280 GO TO 9700
9300 PRINT AT 8,12;"REMEMBER": P
RINT AT 9,0: GO TO E*50+9300
9350 PRINT "Use keys ";K$(1);" a
nd ";K$(2);" to avoid the   obst
acles. Be prepared for the  spee
d increase towards the end '": G
O TO 9700
9400 PRINT "Press key ";K$(4);"
when Santa is over  the rooftop.
": GO TO 9700
9450 PRINT "Press key ";K$(2);"
to step onto the    lift. When t
he brick disappears press key ";
K$(1);" to step off.": GO TO 970
0
9500 PRINT "Press key ";K$(1);"
to move towards the tree and key
 ";K$(3);" to jump the       snow
balls.": GO TO 9700
9550 PRINT "Press key ";K$(3);"
as fast as you can  to achieve h
eight. Don't hold   key ";K$(3);
" down, it won't work '"
9700 PRINT AT 21,3;"PRESS ANY KE
Y TO CONTINUE"
9710 IF INKEY$="" THEN  GO TO 97
10
9720 PRINT AT 3,0,,,,,,,,,,,,,,,,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
9730 RETURN
9800 REM NEXT SCREEN MESSAGE
9810 CLS : PRINT AT 6,11;"YEAR:"
;Y+1984;AT 12,12;"STAGE ";E: FOR
 F=1 TO 80: NEXT F: CLS : GO SUB
 9300: RETURN
9820 REM END OF SCREEN MESSAGE
9830 CLS : PRINT AT 5,11;"YEAR:"
;Y+1984;AT 10,0;"WELL DONE ! - S
TAGE ";E;" COMPLETED";AT 15,11;"
SCORE:";S
9840 FOR F=10 TO 25: BEEP .1,F:
NEXT F: FOR F=1 TO 200: NEXT F
9850 RETURN
9900 REM TRAFFIC LIGHTS
9910 PRINT AT 1,0; INK 2;"P";AT
2,0; INK 6;"O";AT 3,0; INK 4;"O"
: FOR F=1 TO 50: NEXT F: PRINT A
T 2,0; INK 6;"P": FOR F=1 TO 50:
 NEXT F: PRINT AT 1,0; INK 2;"O"
;AT 2,0; INK 6;"O";AT 3,0; INK 4
;"P": RETURN
```

Painters

A brilliant two-player machine-code game which is a 1K masterpiece from Barry Smith.



Once this program has been entered then SAVE it before RUNning as the slightest error will cause all your work to be lost!

The plot

Two decorators are frantically rushing around a room each desperately trying to paint as much of the floor as possible. You must guide their brushes to help them achieve this aim. Ten points are awarded for each brush stroke that covers an unpainted section of floor. If in their haste, either worker strays onto those parts of the room that have so far been painted they will be fired; this news causes them to flush angrily. The last worker to be sacked is the one to whom the score is given. Tea breaks are allowed only at the discretion of either player.

Control keys

Painter One who starts work at the left of the room is controlled with the following keys

Shift — Up
Z — Down
X — Left
C — Right

Painter two who starts work at the right of the room is controlled by a second set of keys

N — Up
M — Down
— Left
Space — Right

Press T and both workers stop for a tea break until you tell them to start work again by pressing Y

Entering the game

Type in Line 1 of the Hex Loader; it has 321 characters after the REM statement, that is 10 full lines and one extra character. Now as a direct command type CLS then enter Line 2 which has four full lines and 19 extra characters after its REM. You may now enter the rest of the program normally and need not worry if any of the lines float to the top of the screen. RUN the program. ENTER one line of code from the Hex Dumps. After the last line from Hex Dump 2 has been typed in the computer will stop with the report 0/80. Delete lines 80-10 in that order and add the line 3 RAND USR 16536; the fame is now ready for playing.

GOOD LUCK

Pokes

You may like to POKE

16537 — the paint used by Painter one
16542 — the paint used by Painter Two
16828 — the speed of the game. This is initially 13 and ranges from 1 = impossibly fast to 255 = incredibly slow

```
HEX LOADER
--- ------

   1 REM EEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEE
   2 REM EEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEEEEEE
EEEEEEEEEEEEEEEEEEEEEEEEEEEE
  10 LET A$=""
  20 FOR A=16514 TO 15967
  30 LET A=A+(A=16535)*6
  40 IF A$="" THEN INPUT A$
  50 POKE A,16*CODE A$+CODE A$(2
)-476
  60 PRINT AT 0,0,A,"  ",A$( TO 2
)
  70 LET A$=A$(3 TO )
  80 NEXT A
```

```
HEX DUMP 1
--- ---- -

16514   68 AB 84 87 AA 06 9C 9C
16522   9C 9C AD AE 06 9C 9C 9C
16530   9C A7 87 8A 86 AD 3E 97
16538   32 2C 41 3E 97 32 44 41
16546   01 6E 08 2A 0C 40 E5 E5
16554   E5 E5 E5 09 22 26 41 01
16562   65 00 E1 09 22 3E 41 3E
16570   2A 32 1A 42 3E 3C 32 2D
16578   42 21 00 00 22 7E 41 7C
16586   32 18 41 06 08 E1 0E 1A
16594 : 23 C5 E5 CD 96 09 E1 C1
16602   11 08 60 72 79 FE 1A 28
16610   01 73 0D 20 E5 73 23 10
16618   E5 06 19 26 73 18 FC 0E
16626   0A D1 13 21 02 4B ED 60
16634   3E 08 06 09 12 13 10 FC
16642   BE 07 ED 60 01 79 00 11
16650   9D A6 E1 09 01 34 40 15
16658   72 3E 31 02 0A FE 88 28
16666   F6 7A 88 20 F2 16 60 72
16674   21 18 41 01 80 00 8A FE
16682   60 3E 97 02 28 0D CB FE
16690   C6 80 32 2C 41 C6 76 20
16698   02 CB EE 01 00 00 0A FE
16706   60 3E 97 02 28 07 CB F6
16714   C6 60 32 44 41 CB 7E 28
16722   2A CB 76 28 26 ED 4B 7E
16730   41 2A 8E 41 09 22 8E 41
16738   01 0C 00 E1 09 54 5D BE
16746   05 21
```

```
HEX DUMP 2
--- ---- -

16748   93 40 ED 50 13 21 18 41
16756   3E 90 C6 6E 28 01 3C 12
16764   C9 21 80 80 23 22 7E 41
16772   01 09 80 E1 E5 09 CD 4E
16780   42 21 80 00 7C 85 26 06
16788   28 22 6E 41 18 0E 21 91
16796   40 CD 4E 42 0E 19 E1 E5
16804 : 60 CD 4E 42 3E F8 D6 FE
16812   C6 67 20 06 3E DF D6 FE
16820   CB 67 20 F6 21 34 40 06
16828   0D 70 46 10 FD 18 06 2A
16842 : 1A 42 3E FE D8 FE C8 47
16850 : 20 02 2E 33 C8 4F 20 02
16858 : 2E 36 C8 57 20 02 2E 3C
16866 : C8 5F 20 02 2E 2A 22 1A
16874   42 2A 2D 42 3E 7F D6 FE
16882   C6 47 20 02 2E 2A C6 4F
16890   20 02 2E 3C C6 57 20 02
16898   2E 36 C6 5F 20 02 2E 33
16906   22 2D 42 0E 16 3A 18 41
16914   C6 7F 28 06 2A 26 41 3E
16922   2A CD 37 42 22 26 41 3A
16930   18 41 C6 77 C2 22 41 2A
16938   3E 41 3E 3C CD 37 42 22
16946   3E 41 C3 22 41 FE 33 20
16954   05 C6 00 ED 42 C9 FE 2A
16962   20 02 23 C9 FE 36 20 02
16970   09 C9 26 C9 7E FE A5 28
16978   03 3C 77 C9 3E 9C 77 26
16986   18 F2
```

Gold!

Mark Richardson presents this tribute to avarice — he assures us that they're not all diggers in Maidstone

The lure of that yellow stuff. I can almost smell it more than a teacher gets in a week! The trouble is that nothing comes easy and the previous owner put some pretty formidable obstacles in the way of getting hold of it

I know it s in the castle but the first job is getting in there the gatekeeper wants a pass number before letting me enter and I think he has cannabalistic tendencies Still he s pretty thick and keeps saying if I m too high or low Once inside there are rumoured to be more varied and objectionable nasties to overcome before finding the gold and escaping with it

Mark has produced an entertaining program which shows how a few interesting but in themselves uninspired games can be linked together to produce a much more affective game Random factors have been used with the aim of producing a game wh ch makes it a challenge to everyone — including the programmer who types it in as there are no preset codes which will help the typist solve the game

To enhance the end result a variety of BEEPs and graphics have been used at appropriate points As the program is essentially a suite of subgames variables are repeated in each sect on and kept to a minimum and are

A	Line 520 centre line of gateway
B/C	Line 4210 points of sword
D	Man
E	Bag of gold
F	Hound

The POKE 23658 8 is to set Caps Lock on, so that all entries are made in capitals and saves double checking for upper/lower case

```
   1 REM ************************
         *Underlined characters*
         *are entered in       *
         *GRAPHICS mode.       *
         ************************

   5 REM ########GOLD'########
  13 REM
  15 CLS : PAPER 7: CLS
  20 FOR N=1 TO 140: PRINT  INK
6;"     ";: NEXT N: BORDER 6
  30 PRINT AT 21,29; INK 6;"
"
  40 FOR N=8 TO 12: PRINT AT N,1
0; PAPER 6; BRIGHT 1;"
  ": NEXT N
  50 GO SUB 0600
  60 FOR M=1 TO 5: FOR M=20 TO 4
0: BEEP .02,M: NEXT M: NEXT N
  70 BORDER 6: INK 0: PAPER 7: C
LS
  80 GO SUB 8000
  90 POKE 23658,8
  99 REM ###INSTRUCTIONS###
 100 CLS
 110 PRINT "YOU ARE SEARCHING FO
R "; INK 0; BRIGHT 1; PAPER 6;"G
OLD"
 120 PRINT : PRINT : PRINT : PRI
NT
 130 PRINT "BEHIND THE CASTLE GA
TE IS A     FIERCE GATE-KEEPER."
: PRINT " HE HAS ASKED YOU FOR T
HE              PASSNUMBER! ": P
RINT " IT IS BETWEEN 1 AND 100.
       HE WILL GIVE YOU 6 GUESSE
S.": PRINT " BE CAREFUL THOUGH H
E'S "; INK 2;"VERY "; INK 0;"
 HUNGRY!"
 140 PRINT : PRINT  INK 3;"PRESS
 ANY KEY TO CONTINUE": PAUSE 0:
CLS
```

```
499 REM ###PRINT   GATE###
500 INK 2
510 PRINT AT 7,9;"
  "
520 LET B$="
 "
530 FOR N=8 TO 13
540 PRINT AT N,8;B$: NEXT N
550 PRINT AT 14,8;"    O O
    "
560 FOR N=15 TO 19
570 PRINT AT N,8;B$: NEXT N
580 FOR N=10 TO 40 STEP 2: BEEP
.02,M: NEXT M
590 INK 0
600 LET TR=6: LET X=1+INT (RND*
100)
999 REM ##QUES#   NUMBER###
1000 IF TR=0 THEN  CL# : PRINT A
T 10,0;"SORRY YOU HAVE BEEN EATE
N BY THE GATE KEEPER-YOU ARE DEA
D": FOR N=1 TO 3: BEEP 1,-5: BEE
P 1.5,-10: NEXT N: GO TO 8500
1010 INPUT "PICK A NUMBER BETWEE
N 1-100 "IZ
1020 IF Z<1 OR Z>100 THEN  GO TO
 1010
1030 IF X=Z THEN  BORDER 0: PAPE
R 1: CLS : INK 6: PRINT AT 0,0;"
YOU ARE AMAZING,YOU HAVE FOUND
THE  PASSNUMBER": FOR N=1 TO 50:
 BEEP .01,N: NEXT N: FOR N=50 TO
 1 STEP -1: BEEP .01,N: NEXT N:
BEEP 1,25: GO TO 1500
1040 IF Z>X THEN  PRINT AT 0,0;"
TOO HIGH,TRY AGAIN": LET TR=TR-1
: GO TO 1000
1050 IF Z<X THEN  PRINT AT 0,0;"
TOO LOW,TRY AGAIN  ": LET TR=TR-
1: GO TO 1000
1499 REM ###THREE   DOORS###
1500 BORDER 0: PAPER 1: INK 6: C
LS
1505 PAUSE 50: PLOT 90,0: DRAW 0
,100: DRAW -90,10
1510 PLOT 165,0: DRAW 0,100: DRA
W 90,10
1520 CIRCLE 127,80,10: PLOT 127,
70: DRAW 0,-20: DRAW 15,-20
1530 PLOT 112,30: DRAW 15,20: PL
OT 112,55: DRAW 15,15: DRAW 15,-
15
1540 LET W$="      "
1550 LET X$="   O "
1560 FOR N=0 TO 1: PRINT AT N,1;
 INK 4;W$;AT N,13; INK 2;W$;AT N
,25; INK 6;W$: NEXT N
1570 PRINT AT 2,1; INK 4;X$;AT 2
,13; INK 2;X$;AT 2,25; INK 6;X$
1580 FOR N=3 TO 5
1590 PRINT AT N,1; INK 4;W$;AT N
,13; INK 2;W$;AT N,25; INK 6;W$:
 NEXT N
1600 PRINT AT 0,0;"1";AT 0,12;"2
";AT 0,24;"3"
1700 LET DR=1+INT (RND*3)
1710 INPUT "WHICH DOOR?";CD
1720 IF CD=DR THEN  GO TO 2000
```

```
1730 IF CD<>DR THEN  GO TO 4000
1999  REM ### GOLDSEARCH ###
2000 BORDER 5: PAPER 7: INK 0: C
LS
2010 PRINT AT 0,0;"YOU'VE FOUND
THE RIGHT DOOR      THE GOLD IS H
IDDEN IN THIS ROOM.TO FIND IT YO
U MUST MOVE WITH    THE CURSOR KE
YS.  GOOD LUCK!"
2020 FOR N=1 TO 6: FOR M=0 TO 40
 STEP 5: BEEP .15,N: NEXT M: NEX
T N: CLS
2030 LET X=INT (RND*22)
2035 LET Y=INT (RND*32)
2040 PRINT AT X,Y; INK 7;"G"
2050 LET A=12: LET B=12
2060 PRINT AT A,B;" "
2070 IF INKEY$="" THEN  GO TO 20
70
2075 IF INKEY$="5" THEN  PRINT A
T A,B;" ": LET B=B-1
2080 IF INKEY$="6" THEN  PRINT A
T A,B;" ": LET A=A+1
2085 IF INKEY$="7" THEN  PRINT A
T A,B;" ": LET A=A-1
2090 IF INKEY$="8" THEN  PRINT A
T A,B;" ": LET B=B+1
2100 IF A<=0 THEN  LET A=0
2105 IF A>=21 THEN  LET A=21
2110 IF B<=0 THEN  LET B=0
2115 IF B>=31 THEN  LET B=31
2120 IF ATTR (A,B)=63 THEN  GO T
O 2500
2130 GO TO 2060
2200 PRINT AT A,B;" "
2499 REM ###FIND   GOLD###
2500 BORDER 2: PAPER 6: INK 2: C
LS
2505 PRINT  FLASH 1;AT 10,0;"!!!
!YOU HAVE FOUND THE GOLD!!!!!": 
FOR N=1 TO 10: BEEP .2,25: BEEP
.1,15: BEEP .3,20: NEXT N
2500 PRINT AT A,B;" ": PAUSE 15
0
2510 BORDER 6: PAPER 7: CLS : IN
K 0
2520 PRINT AT 4,1;"YOU STILL HAV
E A DREADFUL        HOUND TO OVER
COME BEFORE YOU     CAN TAKE YOUR
 GOLD HOME."
2530  PRINT AT 8 ,1;"HE IS GUARD
ING THE EXIT TO THE  CASTLE.  LU
CKILY YOU FIND THREE STONES ON T
HE GROUND.           CAN YOU KIL
L HIN WITH ONE OF    THESE?"
2540 PRINT AT 14,1;"CHOOSE YOUR
ANGLE CAREFULLY      (Between 50
and 80 degrees)"
2550 PAUSE 800
2599  REM ## CONQUER HOUND ###
2600 BORDER 4: PAPER 1: INK 6: C
LS
2610 LET H=INT (RND*25+5)
2620 PRINT AT 21,0; INK 7;" ";A
T 21,1; INK 2;"
                 "
2630 PRINT  INK 6;AT 19,H;"
";AT 20,H;"   ";AT 21,H;"
";AT 21,H; BRIGHT 1;" "
2640 FOR B=1 TO 3
2650 PRINT AT 1,0;"SHOT NO.";S:
INPUT "Enter angle of shot"; A
2660 LET A=INT A: IF A>80 THEN
INPUT "Angle too great,enter aga
in";A
2665 IF A<50 THEN  INPUT "Angle
too small, enter again";A
2670 FOR N=0 TO 100
2680 LET X=INT (0.062*N*(90-A)):
 LET B=N*(100-N): LET Y=INT (B*0
.05): PLOT X,Y
2690 BEEP 0.1,B/100
2700 LET L=21-INT (Y/8): LET C=I
NT (X/8): IF ATTR (L,C)>64 THEN
 GO TO 2750
2710 NEXT N
2750 IF C=H THEN  GO TO 2800
2780 NEXT B: IF B>3 THEN  PRINT
AT 10,2;"OH, DEAR, YOU FAILED.
          NOW YOU WILL STARVE TO
DEATH     IN THE CASTLE": PAUSE 2
50: GO TO 8500
2790 INPUT "Press ENTER for anot
her shot";Z$: GO TO 2640
2800  PRINT  FLASH 1;"YOU HAVE K
ILLED THE DREADFUL    HOUND.  NO
W YOU MAY GO THROUGH  THE DOOR W
ITH THE GOLD": FOR N=1 TO 5: BEE
P .5,12: BEEP .75,20: NEXT N: GO
 TO 3000
2999 REM ###GET   HOME###
3000 BORDER 4: PAPER 7: CLS : IN
K 0
3010 PRINT AT 5,0;" YOU ESCAPE F
ROM THE CASTLE AND  FIND YOURSEL
F WITH THE GOLD AT   THE TOP OF
A GRASSY HILL."
3020 PAUSE 100
3030 IF RND>.7 THEN  PRINT AT 10
,0;"SUDDENLY YOUR BAG OF GOLD
    DROPS, AND IN YOUR HASTE TO
    RETRIEVE IT YOU TRIP.
     YOU ARE FALLING....": FOR N
```

```
=14 TO 21: PRINT AT N,3;"falling
...": NEXT N: FOR N=1 TO 3: FOR
M=50 TO 0 STEP -2: BEEP .03,M: N
EXT M: NEXT N: BEEP 1.5,-10: BEE
P 2,-25: GO TO 8500
3040 PRINT AT 10,0;"YOU WALK DOW
N THE HILL SLOWLY.  YOU ARRIVE H
ONE AND LIVE IN      PEACE WITH A
LL YOU NEED.'''      CONGRATULAT
IONS!": FOR B=5 TO 35 STEP 5: BE
EP .5,8: NEXT B: FOR B=36 TO 4 S
TEP -4: BEEP .3,8: NEXT B
3050 PAUSE 100: GO TO 8500
3999 REM ###LIFT###
4000 LET M=1+INT (RND*2)
4010 IF CD=M THEN  BORDER 6: INK
 0: PAPER 7: CLS : LET T#=6: LET
 X=1+INT (RND*100): PRINT AT 10,
1;"IT WAS A LIFT!
   LOOK WHERE YOU ARE NOW!!
   (PRESS ANY KEY TO SEE)": PAUS
E 0: CLS : GO TO 500
4019 REM ###DRAGON###
4020 IF CD<>M THEN  BORDER 2: PA
PER 7: CLS : INK 0: PRINT  INK 1
; PAPER 6;"THERE IS A DRAGON!!!"
4030 DIM A$(10,18)
4040 LET A$(1)="
          "
4045 LET A$(2)="
          "
4050 LET A$(3)="
          "
4055 LET A$(4)="
          "
4060 LET A$(5)="
          "
4065 LET A$(6)="
          "
4070 LET A$(7)="
          "
4075 LET A$(8)="
          "
4080 LET A$(9)="
          "
4085 LET A$(10)="
          "
4090 FOR N=1 TO 10: PRINT AT N+5
,6; INK 2;A$(N): NEXT N: FOR M=1
 TO 4: BEEP 1,-10: BEEP 1,-5: NE
XT M
4100 PAPER 7: INK 0: CLS
4110 PRINT AT 4,0;"WILL YOU ADVA
NCE (Key ""1"") OR RETREAT? (Key
 ""0"")"
4120 IF INKEY$="" THEN  GO TO 41
20
4125 IF INKEY$="1" THEN  GO TO 4
200
4130 IF INKEY$="0" THEN  GO TO 1
500
4200 PRINT AT 8,4;" ";AT 9,4;"
 ";AT 11,4;" ";AT 12,4;" "
4210 PRINT AT 10,0;"
          "
4220 PRINT AT 14,0;"YOU SEE A SW
ORD LEFT BY A        PREVIOUS ADV
ENTUREN.": PAUSE 100
4230 IF RND>.5 THEN  PRINT AT 17
,0;"UNFORTUNATELY THE DRAGON'S F
IRE BURNS YOU TO DEATH AS YOU
    PICK UP THE SWORD!": FOR N=3
8 TO -15 STEP -1: BEEP .1,N: NEX
T N: BEEP 1,-15: GO TO 8500
4240 PRINT AT 17,0;"YOU STAB THE
 DRAGON IN IT'S      HEART.": BEE
P 3,-20: PRINT AT 19,0;"BEHIND T
HE BODY IS A CORRIDOR   OPEN THE
 DOOR AT THE END...": PAUSE 200:
 GO TO 2000
7999 REM ###GRAPHICS###
8000 FOR M=0 TO 5: FOR N=0 TO 7
8010 READ C: POKE USR CHR# (144+
M)+N,C
8020 NEXT N: NEXT M
8030 DATA 247,247,247,247,247,24
7,247,247,128,192,224,240,224,19
2,128,0,1,3,7,15,15,7,3,1
8040 DATA 24,24,60,90,24,36,36,6
6,60,24,60,126,255,255,126,60,32
,238,226,62,62,34,33,129
8050 RETURN
8499 REM ###AGAIN?###
8500 PAPER 7: CLS : BORDER 3: IN
K 0
8510 PRINT AT 10,1;"DO YOU WANT
TO PLAY AGAIN"
8520 IF INKEY$="" THEN  GO TO 85
20
8530 IF INKEY$="Y" THEN  BORDER
6: CLS : GO TO 499
8540 IF INKEY$="N" THEN  CLS : P
RINT AT 8,4;"THANK YOU FOR PLAYI
NG";AT 10,10;"GOODBYE"
8550 STOP
8599 REM ###TITLE###
8600 INK 0: PRINT AT 9,11; PAPER
 6; BRIGHT 1;"
 "
8610 PRINT AT 10,11; PAPER 6; BR
IGHT 1;"            "
8620 PRINT AT 11,11; PAPER 6; BR
IGHT 1;"            "
8630 RETURN
```

Poojan

Pim Quakkelaar gives us the Netherlands version of 'The Three Little Pigs.'

It is the nature of things that wolves try to eat the pigs and the pigs not surprisingly are none too keen on the idea

The wolves though are getting clever and here we find them trying two different ways of achieving their aim first by ballooning out of a tree to the ground to reach the piglets and then if this fails ballooning up into the tree in order to push boulders on top of you

Of course as parent pig you're not going to stand by and let all this happen and are positioned in your vertically moving cage armed with a bow and arrows with which to puncture the wolve s hopes and balloons

We'll let Pim explain the whole sordid thing in glorious technicolour detail

Your Task

After the introduction the control keys are displayed and you move into the first stage of the game The program can continue indefinitely but consists of three main screens Using your bow and arrow, you must shoot the wolf s balloon to prevent him from reaching the piglets If the wolf manages to land safely he will eat one of them

On the second screen you have to shoot as many balloons as possible and in the third you also have to face the rocks that the wolf will try to throw at you

The Score

On the first screen you earn points for hitting the wolf or the balloon The wolf is worth ten points but the score for the balloons depends on how far away they are The higher up in the sky the balloon the more points you score for hitting it

The further you progress in the game the harder the screens become

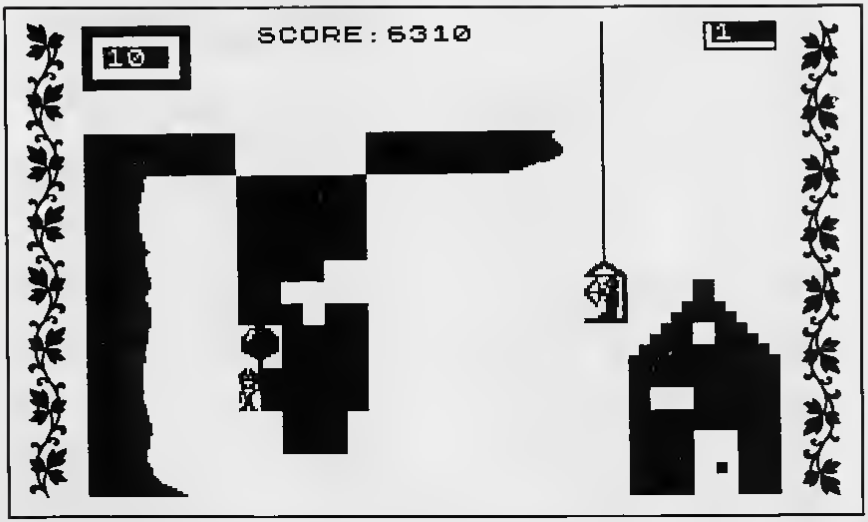
Program Details

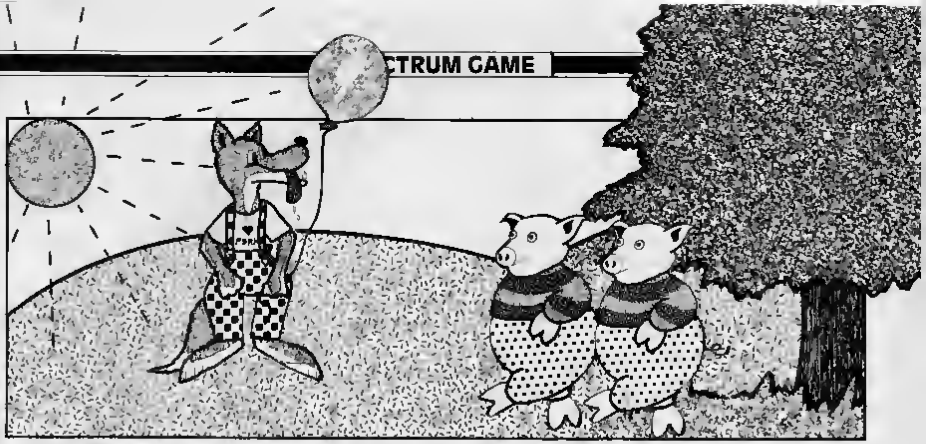
20 170	Introduction
175 200	Control keys
250	Variables
255 2035	Screen1
2400 2890	Screen2
3000 8499	Screen3
8500 8525	Tree for screens 2 & 3
9000 9400	Hall of Fame (input routine)
9500 9555	UDGs
9600 9840	Hall of Frame (calculations routine)

Variables

bon the score at which you earn two extra pigs
mnow maximum number of wolves needed to throw the rock
dis the distance that the wolves jump from
cag number of cages that you own
now w wl the number of wolves on different screens
pig the number of pigs you have
sc score
stage stage counter

Once you've got the program typed in it can be saved with the command SAVE 'Poojan LINE 1





```
  1 REM ***********************
        *Underlined characters*
        *are entered in       *
        *GRAPHICS mode.       *
        ***********************

  20 CLS : PRINT AT 10,0;"READIN
G GRAPHICS; HANG ON A SEC."
  30 GO SUB 9500
  40 INK 7: PAPER 0: BORDER 0: B
RIGHT 1: CLS
  45 LET z$="P.Q.PRODUCTIONS PRE
SENTS": FOR z=1 TO LEN z$: PRINT
 AT 3,z+3;z$(z): PAUSE 5: NEXT z
: RESTORE 45: FOR n=1 TO 3: READ
 t: BEEP .15,t: NEXT n: DATA 0,2
,4: BEEP .35,7: BEEP .20,4: BEEP
 .3,7
  50 RESTORE 50: DIM a(6): FOR t
=1 TO 6: READ a(t): NEXT t: DATA
 10,12,14,16,18,20: FOR x=1 TO 6
: FOR y=20 TO 10 STEP -1: PRINT
AT y,a(x); INK x+1;"CD";AT y-1,a
(x); INK x+1;"RB": BEEP .025,y/x
:: PRINT AT y,a(x);"  ": NEXT y:
 PRINT AT y+1,a(x); INK x+1;"CD"
: PRINT AT 3,4; INK X+1; BRIGHT
1;"P.Q.PRODUCTION@ PRESENTS": NE
XT x
  60 INK 6: BRIGHT 1: FOR x=1 TO
 6: PRINT AT 9,a(x);"RS";AT 10,a
(x);"TU": BEEP .01,0: BEEP .01,5
: BEEP .01,10: PRINT AT 9,a(x);"
  ";AT 10,a(x);"  ": GO SUB 100:
 NEXT x
  70 GO TO 165
  100 GO TO 100+(x*10)
  110 PLOT 84,90: DRAW 0,10: DRAW
 10,-1,-1.5: DRAW -7,-5,-1.5: DR
AW 0,2: DRAW 3,3,.5: RETURN
  120 CIRCLE 102,95,6: CIRCLE 102
,95,4: RETURN
  130 CIRCLE 118,95,6: CIRCLE 118
,95,4: RETURN
  140 PLOT 128,88: DRAW 5,0: DRAW
 5,13,1.5: DRAW -7,0: DRAW 0,-2:
 DRAW 5,0: DRAW -5,-9,-2.5: DRAW
 -3,0: DRAW 0,-2: RETURN
  150 PLOT 144,90: DRAW 0,8: DRAW
 14,0,-2: DRAW 0,-8: DRAW -3,0,-
2: DRAW 0,4: DRAW -8,0: DRAW 0,-
4: DRAW -2,0,-2: PLOT 147,97: DR
AW 6,0: DRAW -6,0,1: RETURN
  160 PLOT 163,92: DRAW 0,10: DRA
W 3,0,-1: DRAW 10,-10,2: DRAW 0,
10: DRAW 3,0,-1: DRAW 0,-13: DRA
W -3,0: DRAW -10,5,-2: DRAW 0,-5
: DRAW -3,0,-2: DRAW 0,3: RETURN

  165 FOR t=1 TO 2: FOR y=0 TO 1:
 FOR x=1 TO 7: PLOT  INK x; BRIG
HT y;56,72: DRAW  INK x; BRIGHT
y;150,0: BEEP .02,0: DRAW  INK x
; BRIGHT y;0,4R: BEEP .02,7: DRA
W  INK x; BRIGHT y;-150,0: BEEP
 .02,9: DRAW  INK x; BRIGHT y;0,-
4R: BEEP .02,5: NEXT x: NEXT y:
NEXT t
  170 BEEP 1,0: BEEP 1,-12
  175 DIM s(10): DIM n$(10,20): F
OR t=1 TO 10: LET n$(t)=" ??????
??????????? ": NEXT t
  180 INK 6: BRIGHT 1: CLS
  185 LET z$="CONTROL": FOR z=1 T
O LEN z$: PRINT AT 2,z+12;z$(z);
: PAUSE 2: NEXT z
  187 LET z$="UP   ........... KEY
A": FOR z=1 TO LEN z$: PRINT AT
 6,z+5;z$(z);: PAUSE 2: NEXT z
  189 LET z$="DOWN ........... KEY
```

```
 Z": FOR z=1 TO LEN z$: PRINT AT
 8,z+5;z$(z);: PAUSE 2: NEXT z
 191 LET z$="FIRE ..........  SPA
CE": FOR z=1 TO LEN z$: PRINT AT
 10,z+5;z$(z);: PAUSE 2: NEXT z
 193 LET z$=" 2 BONUS PIGR AT 10
,000 AND": FOR z=1 TO LEN z$: PR
INT AT 19,z+1;z$(z);: PAUSE 2: N
EXT z
 195 LET z$="EVERY 20,000": FOR
z=1 TO LEN z$: PRINT AT 21,z+9;z
$(z);: PAUSE 2: NEXT z
 199 PAUSE 50: LET z$="Press any
 key to play.": FOR z=1 TO LEN z
$: PRINT #1;AT 1,z+5;z$(z);: PAU
SE 2: NEXT z
 200 FOR k=0 TO 800: IF INKEY$="
" THEN  NEXT k: GO TO 9800
 250 LET bon=10000: LET mnow=5:
LET dis=12: LET cag=2: LET now=1
9: LET pig=10: LET sc=0: LET w=1
0: LET stage=1: LET w1=5
 255 INK 5: BORDER 0: BRIGHT 1:
PAPER 0: CLS
 280 LET w1=w1+5
 285 LET w=w1+5: IF w>40 THEN  L
ET w=40
 290 LET dis=dis-2
 295 IF dis<=6 THEN  LET dis=6
 297 LET z$="STAGE ": FOR z=1 TO
 LEN z$: PRINT AT 10,11+z;z$(z);
: PAUSE 3: NEXT z: PRINT stage
 300 RESTORE 301: FOR x=0 TO 135
: READ a: PLOT  INK 4; BRIGHT 1;
0,x: DRAW  INK 4; BRIGHT 1;a,0:
NEXT x
 301 DATA 36,34,32,30,28,26,25,2
4
 302 DATA 23,23,23,22,22,21,21,2
1
 303 DATA 21,21,22,22,22,22,22,2
3
 304 DATA 23,23,23,23,22,22,22,2
1
 305 DATA 21,21,21,20,20,20,20,2
0
 306 DATA 20,20,20,20,20,20,20,2
0
 307 DATA 20,20,21,21,21,21,21,2
1
 308 DATA 21,22,22,22,22,22,22,2
3
 309 DATA 23,23,23,23,23,23,23,2
2
 310 DATA 22,21,21,22,22,23,23,2
3
 311 DATA 23,23,22,22,22,22,21,2
1
 312 DATA 21,21,22,23,22,21,21,2
1
 313 DATA 20,20,20,19,19,19,19,1
9
 314 DATA 19,19,19,19,19,19,20,2
0
 315 DATA 20,20,21,21,21,21,21,2
2
 316 DATA 156,161,163,166,171,17
3,175,176
 317 DATA 176,176,175,174,173,17
2,172,173
 325 PRINT AT 0,0;"▄▄▄▄▄▄";AT 1,0
;"▌    ▐";AT 2,0;"▀▀▀▀▀▀"
 330 PRINT AT 0,8;"SCORE:";sc
 335 PRINT AT 12,25; INK 2; PAPE
R 0;"  ▄▄";AT 13,25;"  ▄▄";AT 1
4,25;"  ▄▄ ▄▄";AT 15,25;"▄▄▄▄▄▄▄▄
;AT 16,25; PAPER 1; INK 4; BRIGN
T 0;"▄▄▄▄▄▄▄▄";AT 17,25;"▄▄  ▄▄▄▄
";AT 18,25;"▄▄▄▄▄▄▄▄";AT 19,25;"▄▄
▄  ▄▄";AT 20,25;"▄▄▄  ▄▄▄";AT 21,
25;"▄▄▄  ▄▄▄"
 340 FOR x=0 TO 7: PRINT AT x,23
; INK 6;"E": NEXT x
 345 PLOT 229,165: DRAW 26,0: DR
AW 0,10: DRAW -26,0: DRAW 0,-10:
 PRINT AT 0,29; INVERSE 1; PAPER
 1;"  "
 350 LET stage=stage+1: LET u=0:
 LET a$="EQ": LET x2=2: LET y=22
: LET x=7
 400 LET z$="READY ?": FOR z=1 T
O LEN z$: PRINT AT 12,z+11;z$(z)
: PAUSE 3: NEXT z
 410 RESTORE 410: FOR n=1 TO 12:
 READ t: BEEP .30,t: NEXT n: DAT
A 12,10,9,7,5,2,0,0,2,5,4,7: BEE
P .70,5: BEEP .30,5
 420 PRINT AT 10,12;"          ";A
T 12,12;"        "
 500 LET i=INT (RND*5+1.5)
 501 IF i=5 THEN  GO TO 500
 502 LET x3=INT ((dis+RND*4)+.5)
 503 PRINT AT 1,1; INVERSE 1; PA
PER 1;w;" "
 505 IF sc>=bon THEN  LET pig=pi
g+2: LET bon=bon+20000
 510 PRINT AT 0,14;sc;AT 0,29; I
NVERSE 1;pig;" "
 515 IF pig=0 THEN  GO TO 9600
 520 IF w=0 THEN  PAUSE 50: GO T
O 2400
 550 FOR t=1 TO x3
 552 LET t2=t-1
 555 IF t<>x3 THEN  GO TO 750
```

```
 575 LET u=u+1
 578 IF u>=1 AND u<=7 THEN  GO S
UB 2000+u*5
 580 IF u>=19 THEN  LET pig=pig-
1: PRINT AT 16,26; INK 0; PAPER
4; BRIGHT 0;"MAMA'": BEEP .05,12
: BEEP .05,6: BEEP .05,0: PRINT
AT u-1,t2; PAPER 0;"  ";AT u,t2;
 PAPER 0;"  ";AT u+1,t2; PAPER 0
;" ";AT u+2,t2; PAPER 0;" ": LET
 u=0: LET w=w-1: GO TO 500
 600 PRINT AT 16,25; INK 4; BRIG
HT 9;"[redacted]": PRINT AT u,t2; IN
K 1;"AB";AT u+1,t2; INK 1;"CD";A
T u+2,t2; INK 7;"J";AT u+3,t2; I
NK 7;"K";AT u-1,t2; INK 0;"[redacted]":
GO TO 760
 750 PRINT AT 3,t; INK 7;"H";AT
4,t; INK 7;"I";AT 3,t-1;" ";AT 4
,t-1;" "
 755 IF INKEY$="" THEN  GO TO 85
0
 765 IF INKEY$="a" THEN  PRINT A
T x+2,23;"  ";AT x+1,21;"  ": LE
T x=x-1
 770 IF x<=7 THEN  LET x=7
 780 IF INKEY$="z" THEN  PRINT A
T x,23;"E ";AT x+1,21;"  ": LET
x=x+1
 785 IF x>=19 THEN  LET x=19
 810 IF y<>22 THEN  GO TO 850
 820 IF INKEY$=" " THEN  LET x2=
x+1: LET y=y-1: LET a$=""
 850 PRINT AT x,23; INK 6;"LM";A
T x+1,23; INK 6;"NO";AT x+2,23;
INK 6;"PQ";AT x-1,23; INK 6;"E";
AT x+1,21; INK 5;a$
 860 IF t=x3 AND y<>22 THEN  GO
TO 890
 870 IF t=x3 THEN  GO TO 575
 880 IF y=22 THEN  NEXT t
 900 LET y=y-2
1000 IF y<=2 THEN  PRINT AT x2,3
;"  ": LET y=22: LET x2=2: LET a
$="FG": GO TO 1050
1010 PRINT AT x2,y+2;"  "
1020 IF ATTR (x2,y)=64+i THEN  P
RINT AT u,t2;"RS";AT u+1,t2;"TU"
: BEEP .01,0: BEEP .01,5: BEEP .
01,10: LET w=w-i: LET sc=sc+(20-
u)*10: PRINT AT 0,14;sc: PRINT A
T u,t2;"  ";AT u+1,t2;"  ": FO
R z=u+2 TO 20: PRINT AT z,t2; IN
K 2; BRIGHT 1;"J";AT z+1,t2; INK
 2; BRIGHT 1;"K";AT z-1,t2; INK
0;"[redacted]": NEXT z: PRINT AT z-1,t2;"
 ";AT z,t2;" ": BEEP .01,-1: LET
 a$="FG": LET y=22: LET u=0: GO
TO 500
1030 IF ATTR (x2,y)=71 THEN  LET
 sc=sc+10: PRINT AT 0,14;sc: PRI
NT AT u+2,y;"  ";AT u+3,y;"  ":
BEEP .01,6: BEEP .01,12: LET a$=
"FG": LET y=22: GO TO 575
1045 PRINT AT x2,y; INK 5;"FG"
1050 IF t=x3 THEN  GO TO 575
1060 NEXT t
2005 PRINT AT u,t2; INK 1;"AB";A
T u+1,t2; INK 1;"CD";AT u+2,t2;
INK 7;"J";AT u+3,t2; INK 7;"K";A
T 0,5; INK 5;"   SCORE:";sc;"  "
: GO TO 760
2010 PRINT AT u,t2; INK 1;"AB";A
T u+1,t2; INK 1;"CD";AT u+2,t2;
INK 7;"J";AT u+3,t2; INK 7; PAPE
R 4;"K";AT u-1,t2; PAPER 0;"  ":
 GO TO 760
2015 PRINT AT u,t2; INK 1;"AB";A
T u+1,t2; INK 1;"CD";AT u+2,t2;
INK 7; PAPER 4;"J";AT u+3,t2; IN
K 7; PAPER 4;"K";AT u-1,t2; PAPE
R 0;"  ": GO TO 760
2020 PRINT AT u,t2; INK 1;"AB";A
T u+1,t2; INK 1; PAPER 4;"CD";AT
 u+2,t2; INK 7; PAPER 4;"J";AT u
+3,t2; INK 7; PAPER 0;"K";AT u-1
,t2; PAPER 0;"  ": GO TO 760
2025 PRINT AT u,t2; INK 1; PAPER
 4;"AB";AT u+1,t2; INK 1; PAPER
4;"CD";AT u+2,t2; INK 7; PAPER 0
;"J";AT u+3,t2; INK 7; PAPER 0;"
K";AT u-1,t2; PAPER 0;"  ": GO T
O 760
2030 PRINT AT u,t2; INK 1; PAPER
 4;"AB";AT u+1,t2; INK 1; PAPER
0;"CD";AT u+2,t2; INK 7; PAPER 0
;"J";AT u+3,t2; INK 7; PAPER 0;"
K";AT u-1,t2; PAPER 4;"  ": GO T
O 760
2035 PRINT AT u,t2; INK 1; PAPER
 0;"AB";AT u+1,t2; INK 1; PAPER
0;"CD";AT u+2,t2; INK 7; PAPER 0
;"J";AT u+3,t2; INK 7; PAPER 0;"
K";AT u-1,t2; PAPER 4;"  ": GO T
O 760
2400 INK 5: PAPER 0: BORDER 0: B
RIGHT 1: CLS : LET z$="CHANCE ST
AGE": FOR z=1 TO LEN z$: PRINT A
T 10,z+8;z$(z);: PAUSE 3: NEXT z
: GO SUB 8500
2403 DIM b(10,2)
2405 FOR t=1 TO 10
2410 FOR r=1 TO 2
2415 LET b(t,r)=INT ((dis+RND*4)
```

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+.5)
2420 NEXT r
2425 IF b(t,1)=b(t,2) THEN  GO T
O 2410
2430 NEXT t
2506 PRINT AT 0,0;"▄▄▄▄▄▄▄▄"|AT 1,0
;"▌    ▐"|AT 2,0;"▌▄▄▄▄▄▌"
2507 FOR x=0 TO 7: PRINT AT x,23
; INK 6;"E": NEXT x
2510 PRINT AT 12,25; INK 2; PAPE
R 0;"  ▄▄"|AT 13,25;"  ▄▄▄"|AT 1
4,25;" ▄▄ ▄▄"|AT 15,25;"▄▄▄▄▄▄▄▄"
|AT 16,25; PAPER 1; INK 4; BRIGH
T 0;"▄▄▄▄▄▄▄▄"|AT 17,25;"▌  ▄▄▄▄"
|AT 18,25;"▄▄▄▄▄▄▄▄"|AT 19,25;"▄▄
▌  ▄▄▄"|AT 20,25;"▄▄▄ ▄ ▄▄▄"|AT 21,
25;"▄▄▄  ▄▄▄"
2515 PRINT AT 0,0;"SCORE:";sc
2517 LET z$="READY ?": FOR z=1 T
O LEN z$: PRINT AT 12,11+z;z$(z)
;: PAUSE 3: NEXT z: LET stage=st
age+1
2518 RESTORE 2516: FOR n=1 TO 13
: READ t: BEEP .30,t: NEXT n: DA
TA 0,4,0,5,0,7,5,4,4,5,2,0,-1: B
EEP .45,0: PRINT AT 10,8;"
          "|AT 12,12;"          "
2520 LET hit=0: LET r=0: LET cou
nt=10: LET x2=2: LET y=22: LET x
=5: LET a$="FG"
2525 LET r=r+1: LET vv=1: LET v=
1: LET y21=20.6: LET y22=20.3
2526 LET i1=INT (RND*6+1.5): IF
i1=5 THEN  GO TO 2526
2527 LET i2=INT (RND*6+1.5): IF
i2=5 THEN  GO TO 2526
2528 IF i1=i2 THEN  GO TO 2527
2530 IF r=11 THEN  GO TO 2850
2532 IF sc>=bon THEN  LET pig=pi
g+2: LET bon=bon+20000
2535 PRINT AT 1,1; INVERSE 1; IN
K 5;i1-r;" "
2555 IF v=0 AND vv=0 THEN  GO TO
 2525
2557 IF v=0 THEN  GO TO 2575
2560 LET y21=y21-.8
2565 IF INT (y21+.5)<=5 THEN  PR
INT AT 5,b(r,1);"RS"|AT 6,b(r,1)
;"TU": BEEP .01,0: BEEP .01,5: B
EEP .01,10: PRINT AT 5,b(r,1);"
 "|AT 6,b(r,1);"  ": LET v=0: GO
 TO 2572
2570 PRINT AT y21,b(r,1); INK i1
;"CD"|AT y21-1,b(r,1); INK i1;"B
B"|AT y21+1,b(r,1); INK 0;"▄▄"
2572 IF vv=0 THEN  GO TO 2600
2575 LET y22=y22-.5
2580 PRINT AT y22,b(r,2); INK i2
;"CD"|AT y22-1,b(r,2); INK i2;"B
B"|AT y22+1,b(r,2); INK 0;"▄▄"
2585 IF INT (y22+.5)<=6 THEN  PR
INT AT 5,b(r,2);"RS"|AT 6,b(r,2)
;"TU": BEEP .01,0: BEEP .01,5: B
EEP .01,10: PRINT AT 5,b(r,2);"
 "|AT 6,b(r,2);"  ": LET y21=20:
 LET y22=20: GO TO 2525
2590 IF INKEY$="" THEN  GO TO 27
00
2600 IF INKEY$="a" THEN  PRINT A
T x+2,23;"  "|AT x+1,21;"  ": LE
T x=x-1
2605 IF x<=5 THEN  LET x=5
2610 IF INKEY$="z" THEN  PRINT A
T x,23;"  "|AT x+1,21;"  ": LET
x=x+1
2615 IF x>=19 THEN  LET x=19
2617 IF y<>22 THEN  GO TO 2700
2620 IF INKEY$=" " THEN  LET x2=
x+1: LET a$="A": LET y=y-1
2700 PRINT AT x,23; INK 6;"LM";A
T x+1,23; INK 6;"NO"|AT x+2,23;
INK 6;"PQ"|AT x-1,23; INK 6;"E";
AT x+1,21; INK 5;a$
2800 IF y=22 THEN  GO TO 2550
2802 LET y=y-2
2803 IF y<=2 THEN  PRINT AT x2,3
;"  ": LET a$="FG": LET y=22: GO
 TO 2550
2804 PRINT AT x2,y+2;"  "
2807 IF ATTR (x2,y)=64+i2 THEN
PRINT AT y22-1,b(r,2);"RS";AT y2
2,b(r,2);"TU";AT x2,y+2;"  ": BE
EP .01,0: BEEP .01,5: BEEP .01,1
0: PRINT AT y22-1,b(r,2);"  ";AT
 y22,b(r,2);"  ": LET y=22: LET
a$="FG": LET vv=0: LET sc=sc+b(r
,2)*15: PRINT AT 0,14;sc: LET hi
t=hit+1: GO TO 2555
2810 IF ATTR (x2,y)=64+i1 THEN
PRINT AT y21-1,b(r,1);"RS";AT y2
1,b(r,1);"TU";AT x2,y+2;"  ": BE
EP .01,0: BEEP .01,5: BEEP .01,1
0: PRINT AT y21-1,b(r,1);"  ";AT
 y21,b(r,1);"  ": LET y=22: LET
a$="FG": LET v=0: LET sc=sc+b(r,
2)*25: PRINT AT 0,14;sc: LET hit
=hit+1: GO TO 2555
2815 PRINT AT x2,y; INK 5;"FG"
2825 GO TO 2550
2850 FOR g=0 TO 100: CLS
2855 LET z$="NUMBER OF HITS :":
FOR g=1 TO LEN z$: PRINT AT 8,g+
6;z$(g);: PAUSE 3: NEXT g: PRINT
  INK 7;hit
```

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2860 LET z$="BONUS : 100x": FOR
g=1 TO LEN z$: PRINT AT 10,g+5;z
$(g);: PAUSE 3: NEXT g: PRINT ;h
it;"= ";INK 7;100*hit
2870 IF hit=20 THEN  LET z$="EXT
RA BONUS : 25,000": FOR g=1 TO L
EN z$: PRINT AT 13,g+5;INK 6;z$
(g): BEEP .07,CODE z$(g)-60: NEX
T g: LET sc=sc+25000
2880 LET sc=sc+hit*100
2890 RESTORE 2892: FOR n=1 TO 8:
 READ t: BEEP .35,t: NEXT n: DAT
A 12,9,7,9,12,9,7,9: BEEP .5,5
3000 INK 5: CLS : LET z$="STAGE
": FOR z=1 TO LEN z$: PRINT AT 1
0,11+z;z$(z);: PAUSE 3: NEXT z:
PRINT stage: LET stage=stage+1:
GO SUB 8500
3010 LET now=19: LET w=w1+5: LET
 x2=2: LET x=5
3100 PRINT AT 0,0;"▄▄▄▄▄▄▄";AT 1,0
;"▌    ▐";AT 2,0;"▄▄▄▄▄▄▄"
3105 FOR x=0 TO 7: PRINT AT x,23
; INK 6;"E": NEXT x
3110 PRINT AT 12,25; INK 2; PAPE
R 0;"   ▄▄";AT 13,25;"  ▄▄▄▄";AT 1
4,25;"▄▄ ▄▄";AT 15,25;"▄▄▄▄▄▄▄▄
;AT 16,25; PAPER 1; INK 4; BRIGH
T 0;"▄▄▄▄▄▄▄";AT 17,25;"▄  ▄▄▄▄▄
;AT 18,25;"▄▄▄▄▄▄▄▄";AT 19,25;"▄▄
▄  ▄▄";AT 20,25;"▄▄▄ ▄▄▄";AT 21,
25;"▄▄▄  ▄▄"
3115 PRINT AT 0,8;"SCORE:";sc
3120 PRINT AT 1,19; INK 6;"▄▄▄▄";
AT 2,19; INK 6;"▄▄▄"
3130 PLOT 229,165: DRAW 26,0: DR
AW 0,10: DRAW -26,0: DRAW 0,-10:
 PRINT AT 0,29; INVERSE 1; PAPER
 1;"   "
3140 LET z$="READY ?": FOR z=1 T
O LEN z$: PRINT AT 12,11+z;z$(z)
: PAUSE 3: NEXT z: FOR t=0 TO 8
0: NEXT t: PRINT AT 12,12;"
  ";AT 10,12;"          "
3150 LET y2=21: LET a$="FG": LET
 y=22
3152 LET x3=INT ((dis+RND*4)+.5)
3155 LET i=INT (RND*5+1.5): IF i
=5 THEN  GO TO 3155
3157 IF sc>=bon THEN  LET pig=pi
g+2: LET bon=bon+20000
3160 PRINT AT 1,1; INVERSE 1; PA
PER 1;w;" ";AT 0,29;now-(19-now
)
3165 IF 19-now=now THEN  GO TO
5500
3170 IF w=0 THEN  GO TO 5557
3180 PRINT AT y2-1,x3; INK 7;"U"
;AT y2,x3; INK 7;"K": GO TO 3500
3200 LET y2=y2-1
3210 IF y2<=7 THEN  GO TO 5000+y
2*5
3220 PRINT AT y2-3,x3; INK 1;"AB
";AT y2-2,x3; INK 1;"CD";AT y2-1
,x3; INK 7;"U";AT y2,x3; INK 7;"
K";AT y2+1,x3; INK 0;"▄";AT y2-1
,x3+1;"▄"
3400 IF INKEY$="" THEN  GO TO 36
00
3500 IF INKEY$="a" THEN  PRINT A
T x+2,23;"  ";AT x+1,21;"  ": LE
T x=x-1
3505 IF x<=5 THEN  LET x=5
3510 IF INKEY$="z" THEN  PRINT A
T x,23;"  ";AT x+1,21;"  ": LET
x=x+1
3515 IF x>=19 THEN  LET x=19
3520 IF y<>22 THEN  GO TO 3600
3530 IF INKEY$=" " THEN  LET x2=
x+1: LET a$="": LET y=y-1
3600 PRINT AT x,23; INK 6;"LM";A
T x+1,23; INK 6;"NO";AT x+2,23;
INK 6;"PQ";AT x-1,23; INK 6;"E";
AT x+1,21; INK 5;a$
3610 IF y=22 THEN  GO TO 3200
3650 LET y=y-2
3655 IF y<=2 THEN  PRINT AT x2,3
;"  ": LET a$="FG": LET y=22: GO
 TO 3200
3660 PRINT AT x2,y+2;"  "
3670 IF ATTR (x2,y)=64+1 THEN  P
RINT AT y2-3,x3;"RS";AT y2-2,x3;
"TU": BEEP .01,0: BEEP .01,5: BE
EP .01,10: PRINT AT y2-3,x3; INK
 0;"▄▄";AT y2-2,x3;"▄▄": FOR t=y
2 TO 20: PRINT AT t,x3; INK 2;"U
";AT t+1,x3; INK 2;"K";AT t-1,x3
; INK 0;"▄": NEXT t: BEEP .01,-1
: PRINT AT 20,x3; INK 0;"▄";AT 2
1,x3;"▄": LET w=w-1: LET sc=sc+y
2*10: PRINT AT 0,14;sc: GO TO 31
50
3680 IF ATTR (x2,y)=71 THEN  BEE
P .01,6: BEEP .01,12: PRINT AT y
2,x3; INK 0;"▄▄": LET sc=sc+10:
LET a$="FG": LET y=22: GO TO 320
0
3900 PRINT AT x2,y; INK 5;"FG"
4000 GO TO 3200
5010 PRINT AT 1,x3; INK 7;"U";AT
 2,x3;"K";AT 3,x3; INK 4;"▄";AT
1,x3+1; INK 0;"▄";AT 1,x3; INK 0
;"▄";AT 2,x3; INK 0;"▄": LET now
=now-1: LET w=w-1: FOR t=now TO
```

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18: PRINT AT 1,t;"H";AT 2,t;"I";
 NEXT t: LET y2=21: GO TO 3152
5015 PRINT AT 1,x3; INK 1;"CD";A
T 2,x3; INK 7;"J";AT 3,x3; PAPER
 4;"K";AT 4,x3; INK 4;"■";AT 2,x
3+1; INK 0;"■": GO TO 3500
5020 PRINT AT 1,x3; INK 1;"AB";A
T 2,x3;"CD";AT 3,x3; PAPER 4; IN
K 7;"J";AT 4,x3;"K";AT 5,x3; INK
 0;"■";AT 3,x3+1; INK 4;"■": GO
TO 3500
5025 PRINT AT 2,x3; INK 1;"AB";A
T 3,x3; PAPER 4;"CD";AT 4,x3; IN
K 7;"J";AT 5,x3; PAPER 0;"K";AT
6,x3; INK 0;"■";AT 4,x3+1; INK 4
;"■": GO TO 3500
5030 PRINT AT 3,x3; PAPER 4; INK
 1;"AB";AT 4,x3;"CD";AT 5,x3; PA
PER 0; INK 7;"J";AT 6,x3;"K";AT
7,x3; INK 0;"■";AT 5,x3+1;"■": G
O TO 3500
5035 PRINT AT 4,x3; PAPER 4; INK
 1;"AB";AT 5,x3; PAPER 0;"CD";AT
 6,x3; INK 7;"J";AT 7,x3;"K";AT
8,x3; INK 0;"■";AT 6,x3+1;"■": G
O TO 3500
5500 PRINT AT 1,19;"   ";AT 2,19
;"   "
5510 FOR t=1 TO x-2: PRINT AT t,
22; INK 6;"▟▙ ";AT t+1,22; INK 6
;"▜▛ ";AT t-1,22;" E ": BEEP .01
,0: BEEP .01,t: NEXT t
5512 PRINT AT t-1,22;"R";E";AT t,
22;"I";I": PAUSE 5
5515 PRINT AT t-1,22;"   ";AT t,
22;"   "
5517 PRINT AT x+1,21;"   "
5520 FOR t=x+2 TO 21
5540 PRINT AT t-2,23; INK 6;"LM"
;AT t-1,23; INK 6;"NO";AT t,23;
INK 6;"PQ";AT t-3,23;"  ": BEEP
.01,6: BEEP .01,2*t
5545 NEXT t
5550 PRINT AT 19,23;"RS";AT 20,2
3;"__";AT 21,23;"TU": BEEP .01,0
: BEEP .01,5: BEEP .01,0
5555 PRINT AT 19,23;"  ";AT 20,2
3;"  ";AT 21,23;"  ": PAUSE 5: L
ET cag=cag-1
5557 PAUSE 50
5560 CLS : PRINT AT 0,10;"SCORE:
";sc: LET z$="PIGS LEFT : ": FOR
 t=1 TO LEN z$: PRINT AT 10,t+9;
z$(t);: PAUSE 5: NEXT t: PRINT p
ig
5565 LET z$="CAGES LEFT : ": FOR
 z=1 TO LEN z$: PRINT AT 12,z+8;
z$(z);: PAUSE 5: NEXT z: PRINT c
ag
5567 IF cag<=0 THEN  PAUSE 200:
GO TO 9600
5570 PAUSE 100
5575 LET mnow=mnow-1: IF mnow<=3
 THEN  LET mnow=3
8499 GO TO 255
8500 RESTORE 8505: FOR x=0 TO 15
1: READ a: PLOT  INK 4; BRIGHT 1
;0,x: DRAW  INK 4; BRIGHT 1;a,0:
 NEXT x
8505 DATA 36,34,32,30,28,26,25,2
3,23,23,23,22,22,21,21,21,21,21,
22,22,22,22,22,23,23,23,23,23,22
,22,22,21,21,21,21,20,20,20,20,2
0,21,21,21,21,21,21,22,22,22,23,
23,23,22,23,22,21
8510 DATA 20,20,20,20,20,20,20,2
0,20,20,21,21,21,21,21,21,22,
22,22,22,22,22,23,23,23,23,23,23
,23,22,22,23,23,23,23,22,23,23,2
3,23,23,22,22,22,22,21,21,21,21,
22,23,22,21,21,21,20,20,20,19,19
,19,19,19
8515 DATA 19,19,19,19,19,19,20,2
0,20,20,21,21,21,21,21,156,16
1,163,166,171,173,175,176,176,17
6,175,174,173,172,172,173
8525 RETURN
9000 DIM m$(6,30): LET m$(2)="
  A B C D E F G H I J K": LET M$
(4)="    L M N O P Q R S T U V":
 LET M$(6)="    W X Y Z . ?   EN
D RUB": LET n=1: INK 6: BRIGHT 1
: CLS
9010 FOR a=2 TO 6 STEP 2: FOR b=
1 TO 25: PRINT AT a,b;m$(a,b): N
EXT b: NEXT a
9012 LET z$="YOU MAY ENTER YOUR
NAME.": FOR z=1 TO LEN z$: PRINT
 AT 18,z+3;z$(z);: PAUSE 2: NEXT
 z: LET z$="( USE UP/DOWN & FIRE
)": FOR z=1 TO LEN z$: PRINT AT
 20,z+4;z$(z);: PAUSE 2: NEXT z
9015 PLOT 48,78: DRAW  INK 7;160
,0:
9020 LET x=2: LET y=5
9030 PRINT AT x,y; OVER 1;"_"
9037 PAUSE 0
9040 IF INKEY$<>"a" AND INKEY$<>
"z" AND INKEY$<>" " THEN  GO TO
9037
9042 IF INKEY$=" " THEN  BEEP .0
5,25: GO TO 9300
9050 IF INKEY$="a" THEN  LET y=y
+2
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9052 IF INKEY$="z" THEN  LET y=y
-2: GO TO 9075
9055 IF y>25 AND x=2 THEN  PRINT
 AT 2,25;"K": LET x=4: LET y=5:
GO TO 9030
9060 IF y>25 AND x=4 THEN  PRINT
 AT 4,25;"V": LET x=6: LET y=5:
GO TO 9030
9062 IF x=6 AND y=19 THEN  PRINT
 AT 6,17;" ": LET x=6: LET y=20:
 GO TO 9030
9064 IF x=6 AND y=22 THEN  PRINT
 AT 6,20;"N": LET x=6: LET y=24:
 GO TO 9030
9065 IF y=26 AND x=6 THEN  PRINT
 AT 6,24;"U": LET x=2: LET y=5:
GO TO 9030
9070 PRINT AT x,y-2; OVER 0;m$(x
,y-2): GO TO 9030
9075 IF y<5 AND x=2 THEN  PRINT
AT 2,5;"A": LET y=24: LET x=6: G
O TO 9030
9080 IF x=6 AND y=22 THEN  PRINT
 AT 6,24;"U": LET x=6: LET y=20
9085 IF x=6 AND y=18 THEN  PRINT
 AT 6,20;"N": LET x=6: LET y=17
9090 IF x=6 AND y<5 THEN  PRINT
AT 6,5;"W": LET x=4: LET y=25
9095 IF x=4 AND y<5 THEN  PRINT
AT 4,5;"L": LET x=2: LET y=25
9285 PRINT AT x,y+2;m$(x,y+2)
9290 GO TO 9030
9305 IF x=6 AND y=20 THEN  GO TO
 9800
9310 IF x<>6 OR y<>24 TNEN  GO T
O 9385
9311 LET n$(j,n)=" ": PRINT AT 1
1,5+n;n$(j,n)
9312 LET n=n-1: IF n<1 THEN  BEE
P .5,-5: BEEP .5,-12: LET n=1
9315 GO TO 9037
9385 LET n=n+1
9390 IF n>19 THEN  GO TO 9800
9395 LET n$(j,n)=M$(x,y)
9397 PRINT AT 11,5+n;n$(j,n): GO
 TO 9037
9400 GO TO 9030
9499 STOP
9500 RESTORE 9505: FOR x=0 TO 16
7: READ v: POKE USR "a"+x,v: NEX
T x
9505 DATA 3,15,19,55,103,111,127
,127: REM 9503 TO 9520 > balloon
(A,B,C,D)
9510 DATA 192,240,248,252,254,25
4,254,254
9515 DATA 127,127,63,15,3,1,1,1
9520 DATA 254,254,252,240,192,12
8,128,128
9525 DATA 1,1,1,1,1,1,1,1: REM >
 rope (E)
9530 DATA 0,0,24,48,127,48,24,0:
 REM 9530 TO 9535 > arrow (F,G)
9535 DATA 0,1,2,4,255,4,2,1
9540 DATA 160,224,176,255,245,25
0,127,112,112,232,208,208,208,20
0,254,254: REM > walking wolfe (
H,I)
9545 DATA 41,189,255,215,255,199
,189,125,71,252,184,184,184,56,1
08,238: REM > falling wolve (J,K
)
9550 DATA 1,3,15,30,56,112,255,0
,0,128,224,240,60,30,255,115,24,
53,100,199,255,199,100,53,251,18
7,251,115,123,251,251,251,24,0,0
,0,3,7,255,255,251,251,243,243,2
43,243,255,255
9560 DATA 0,0,24,24,56,104,0,0,2
4,28,30,59,58,48,0,0,248,240,97,
67,7,15,14,14,0,0,24,15,7,3,1,1
9565 RETURN
9600 CLS : PRINT AT 11,11;"GAME
OVER": PAUSE 150
9602 IF sc<s(10) THEN  GO TO 980
0
9603 FOR j=1 TO 10
9610 IF sc<s(j) THEN  NEXT j
9615 FOR c=9 TO j STEP -1
9620 LET n$(c+1)=n$(c): LET s(c+
1)=s(c): NEXT c
9625 LET s(j)=sc
9627 LET n$(j)=""
9630 GO TO 9000
9800 CLS
9805 PRINT AT 3,10;"HALL OF FAME
"
9810 FOR z=1 TO 10: PRINT AT z+7
,0;n$(z);" -  ";s(z): NEXT z
9815 PLOT 0,0: DRAW  INK 5;255,0
: DRAW  INK 6;0,175: DRAW  INK 7
;-255,0: DRAW  INK 6;0,-175
9820 PAUSE 50: LET z$="Press any
 key to play.": FOR z=1 TO LEN z
$: PRINT #1;AT 1,z+5;z$(z);: NEX
T z
9830 FOR k=1 TO 5: FOR c=1 TO 7:
 PLOT  INK c;0,0: DRAW  INK c;25
5,0: DRAW  INK c;0,175: DRAW  IN
K c;-255,0: DRAW  INK c;0,-175
9835 IF INKEY$<>"" THEN  GO TO 9
840
9837 NEXT c: NEXT k: GO TO 100
9840 GO TO 230
```

Scrabble Board

Robin Thompson takes the tedium out of the game with this ZX81 version for 2-4 players.

On RUNing the program will ask how many people are to play, and will request their names. There will then be a brief pause while the board is set up and displayed. Instructions will be printed, and the game will commence, ending when all the letters have been used and no-one can continue.

Please note that the program has no facilities for correcting a mistake in the players input so care must be taken when typing in words.

Typing the program in should present no problems, other than the graphics characters and these are listed in figure 1.

Variables

The main variables used by the program are as follows:
B$ holds the board
C$ holds the letters to be distributed amongst the players
E$ holds the players letters
X$ holds the players names
X holds the players scores
S1 the start of the display file
P the number of players

Figure 1 Scrabble board graphics

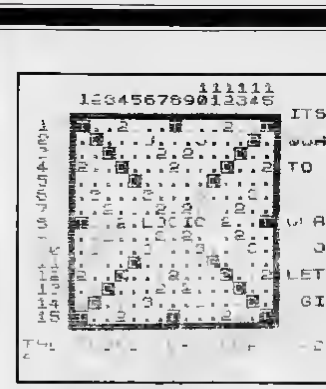
		Line 8430	
		Line 8435	
Line 11	eight graphic S	Line 8445	inverse T
Line 75	inverse space	Line 8450	
Line 7000	inverse T	Line 8460	
Line 7010	inverse D	Line 8465	
Line 8395	inverse space	Line 8470	inverse D
Line 8400	inverse space	Line 8475	

Line by Line

1 to 85	initialisation of variables and instructions
86 to 170	print the scores, who is next to play, their letters, and inputting coordinates for letters on the board
171 to 130	work out the coordinates of letters to go on the board
311 to 318	bonus score of 50 points when a player uses all seven letters in one go
319 to 502	check for double or triple word score, print out score, and prepare for next player's turn

Subroutines

3000	checks to see if your letters are next to any others on the board, and adds the necessary score
3800	POKEs your letter onto the screen
4000	allocates new letters, and prints them on screen
5000	Endgame routine. Works out who scored most, and prints out scores
6000	initialises the array that is to hold the players' letters
7000	works out if player gets double or triple word score
8000	initialises the array that holds the board
9000	asks how many players there are, asks their names, and DIMs arrays to hold their scores, names and letters
9500	prints out the board
9900	routines used when all the letters have been used. Play continues until no one can go
9998	program SAVEd so that it autoruns




```
   4 LET J=0
   5 LET D=0
   6 LET C=0
   7 LET O1=0
   8 LET D1=0
   9 LET W=0
   9 LET Z=0
   9 LET 'E=0
   9 RAND
  10 PRINT  SCRABBLE
  11 PRINT  ========
  12 PRINT
  13 PRINT   I  R. THOMPSON  18
4 04
  14 PAUSE 100
  15 CLS
  19 GOSUB 9000
  80 GOSUB 9000
  81 GOSUB 9500
  85 SLOW
  92 PAUSE 400
  60 CLS
  65 PRINT  TO INPUT YOUR WORD T
YPE IN THE  GRID REFERENCE E.G.
14 FOR      ROW 1,COLUMN 4 104 F
OR          ROW 10 COLUMN 4  OR
1014 FOR    ROW 10 COLUMN 14 AND
 THEN       PRESS NEWLINE
  67 PRINT
  70 PRINT  THEN TYPE THE REQUIR
ED LETTER   AND PRESS NEWLINE.
  72 PRINT
  75 PRINT  WHEN YOU HAVE FINISHE
D YOUR WORD PRESS NEWLINE AND  T
HE SCORE    WILL BE DISPLAYED.
  74 PRINT
  75 PRINT  TO USE A BLANK (REPR
ESENTED     BY [ ] SIMPLY TYPE AN
            INVERSE SPACE.
  77 PAUSE 1100
  78 POKE 16412 0
  79 FAST
  80 CLS
  81 GOSUB 9500
  82 SLOW
  83 PRINT AT 19 0  A [ ] DENOTES
A TRIPLE WORD SCORE A [0] DENOTES
A DOUBLE WORD SCORE A [2] DENOTES
A DOUBLE LETTER     SCORE AND A
3 A TRIPLE LETTER   SCORE
  85 PAUSE 1000
  86 CLS
  87 GOSUB 9500
  90 FOR I=1 TO 5
  91 POKE 16412 0
  92 PRINT AT 19 0
  93 FOR F=1 TO 5
  94 PRINT X$ F; SCORE=  ; F
  95 NEXT F
  96 POKE 16412,2
  97 PRINT AT 2 20  ITS  AT - 2
*$(I  AT 6 20  TO GO
  98 GOSUB 4000
 100 FOR T=1 TO
 101 LET S1=1+PEEK 16396+256*PE
+ 16397
 155 LET R=3
 157 PRINT AT 20 0
          AT 21 0
           AT 19 0
 158 FOR Q=17 TO 21
 159 PRINT AT Q,20
 160 NEXT Q
 164 INPUT L$
 165 IF L$=  THEN GOTO 320
 170 INPUT M$
 171 GOSUB 2500
 172 IF R=1 THEN GOTO 155
 175 IF LEN L$=2 THEN GOTO 200
 180 IF LEN L$=3 THEN GOTO 220
 185 LET K=VAL L$( TO 2)
 190 LET J=VAL L$(3 TO 4
 191 IF T=1 THEN GOSUB 3000
 192 GOSUB 7000
 195 GOTO 300
 200 LET K=VAL L$( 1)
 201 IF K 1 THEN GOTO 100
 204 LET J=VAL L$(2)
 205 IF J 1 THEN GOTO 100
 206 IF T=1 THEN GOSUB 3000
 207 GOSUB 7000
 210 GOTO 100
 220 IF VAL L$ 1  1 THEN LET K=
AL L$(1
 225 IF VAL L$ 1, 1 THEN LET J=
AL L$(2 TO 3)
 230 IF VAL L$(2) 5 THEN LET K=
AL L$( TO 2
 235 IF VAL L$(2  5 THEN LET J=
AL L$(3
 240 IF VAL L$(3) 5 THEN LET K=
AL L$( TO 2)
 245 IF VAL L$(3) 5 THEN LET J=
AL L$(3
 250 IF VAL L$(1  1 OR VAL L$ 2)
5 OR VAL L$(3) 5 THEN GOTO 285
 255 PRINT AT 19 0  PLEASE BE MO
RE SPECIFIC
 260 PRINT AT 20 0, WHAT IS THE
 265 PRINT AT 21 0, ROW NUMBER
 270 INPUT
 275 PRINT AT 21 0  COLUMN NUMBE
R
 280 INPUT J
 285 IF  1 OR J 15 OR K 1 OR K
15 THEN GOTO 100
 286 IF T=1 THEN GOSUB 3000
 290 GOSUB 7000
 300 LET E$ K, J=M$
 302 GOSUB 3300
 310 NEXT T
 311 CLS
 313 PRINT AT 10 0,  WELL DONE
 *$(I)
 314 PRINT
 315 PRINT   YOUVE USED ALL YOUR
 LETTERS     AND GAINED A BONUS
OF 50        POINTS
 316 PAUSE 200
 317 LET Z=Z+50
 315 CLS
 319 GOSUB 9500
 320 IF Q1=7 THEN GOSUB 7100
```

```
 321 IF D1=3 THEN GOSUB 7200
 324 PRINT AT 19,0 "THE SCORE F
R YOUR WORD WAS          "
 325 LET X(I)=X(I)+Z
 326 LET Z=0
 327 PAUSE 150
 328 PRINT AT 19,0
                          ,AT 20,0

 329 FOR J=1 TO 17
 330 PRINT AT J,20

 335 NEXT J
 337 IF U=1 THEN RETURN
 340 NEXT I
 345 GOTO 90
 501 GOSUB 9500
 502 GOTO 222
 950 CLS
2999 REM ++++++++++++++++++++++
3000 FAST
3005 IF J=1 AND K=1 THEN GOTO 3
00
3010 IF K=1 AND J=15 THEN GOTO 3
150
3015 IF K=15 AND J=1 THEN GOTO 3
200
3020 IF K=15 AND J=15 THEN GOTO
3250
3025 IF J=1 THEN GOTO 3300
3030 IF K=1 THEN GOTO 3350
3035 IF J=15 THEN GOTO 3400
3040 IF K=15 THEN GOTO 3450
3050 FOR L=1 TO 26
3055 IF B$(K+1,J)=Z$(L) OR B$(K-
1,J)=Z$(L) OR B$(K,J+1)=Z$(L) OR
B$(K,J-1)=Z$(L) THEN GOTO 3070
3060 NEXT L
3065 SLOW
3067 RETURN
3070 LET Z=Z+F(L)
3075 GOTO 3060
3100 FOR L=1 TO 26
3105 IF B$(K+1,J)=Z$(L) OR B$(K,
J+1)=Z$(L) THEN GOTO 3120
3110 NEXT L
3115 SLOW
3116 RETURN
3120 LET Z=Z+F(L)
3125 GOTO 3110
3150 FOR L=1 TO 26
3155 IF B$(K+1,J)=Z$(L) OR B$(K,
J-1)=Z$(L) THEN GOTO 3170
3160 NEXT L
3165 SLOW
3167 RETURN
3170 LET Z=Z+F(L)
3175 GOTO 3160
3200 FOR L=1 TO 26
3205 IF B$(K-1,J)=Z$(L) OR B$(K,
J+1)=Z$(L) THEN GOTO 3220
3210 NEXT L
3215 SLOW
3217 RETURN
3220 LET Z=Z+F(L)
3225 GOTO 3210
3250 FOR L=1 TO 26
3255 IF B$(K-1,J)=Z$(L) OR B$(K,
J-1)=Z$(L) THEN GOTO 3270
3260 NEXT L
3265 SLOW
3267 RETURN
3270 LET Z=Z+F(L)
3275 GOTO 3260
3300 FOR L=1 TO 26
3305 IF B$(K+1,J)=Z$(L) OR B$(K-
1,J)=Z$(L) OR B$(K,J+1)=Z$(L) TH
EN GOTO 3320
3310 NEXT L
3315 SLOW
3317 RETURN
3320 LET Z=Z+F(L)
3325 GOTO 3310
3350 FOR L=1 TO 26
3355 IF B$(K+1,J)=Z$(L) OR B$(K,
J+1)=Z$(L) OR B$(K,J-1)=Z$(L) TH
EN GOTO 3370
3360 NEXT L
3365 SLOW
3367 RETURN
3370 LET Z=Z+F(L)
3375 GOTO 3360
3400 FOR L=1 TO 26
3405 IF B$(K+1,J)=Z$(L) OR B$(K-
1,J)=Z$(L) OR B$(K,J-1)=Z$(L) TH
EN GOTO 3420
3410 NEXT L
3415 SLOW
3416 RETURN
3420 LET Z=Z+F(L)
3425 GOTO 3410
3450 FOR L=1 TO 26
3455 IF B$(K-1,J)=Z$(L) OR B$(K,
J+1)=Z$(L) OR B$(K,J+1)=Z$(L) TH
EN GOTO 3470
3460 NEXT L
3465 SLOW
3467 RETURN
3470 LET Z=Z+F(L)
3475 GOTO 3460
3800 LET V=CODE U$
3805 POKE 31+(K+33+(2+32)*I+L
3810 RETURN

4000 REM ++++++++++++++++++++++

4025 IF U=1 THEN RETURN
4030 FOR L=1 TO 7
4035 IF S$(I,L)=     THEN GOTO 4
00
4040 NEXT L
4045 PRINT AT 10,20;X$(I); AT 12,
20;"OUR ,AT 14,20;"LETTERS ARE
4047 PRINT AT 16,21
4050 FOR L=1 TO 7
4055 PRINT S$(I,L);
4060 NEXT L
4065 PRINT
4070 RETURN
4100 LET VE=VE+1
4101 LET G=INT (RND*100)+1
4103 IF VE=100 THEN GOTO 9300
4105 IF C$(G)=" " THEN GOTO 4101
4110 LET S$(I,L)=C$(G)
4115 LET C$(G)=
4120 GOTO 4040

5000 REM ++++++++++++++++++++++

5001 LET M=0
5003 FOR I=1 TO 8
5005 IF M<X(I) THEN LET M=X(I)
5015 NEXT I
5020 FOR I=1 TO 8
5025 IF X(I)=M THEN GOTO 5050
5030 NEXT I
5050 PRINT "WELL DONE  ";X$(I)
5060 PRINT "YOUVE WON
5065 PRINT
5070 PRINT "THE SCORES WERE
5080 PRINT
5085 FOR I=1 TO 4
5090 PRINT X$(I);X(I)
5095 NEXT I
5100 PAUSE 1000
```

```
5101 CLS
5105 GOSUB 9500
5110 STOP

5500 REM ****************

5600 FOR A=1 TO 7
5605 IF E$ I,A)=M$ THEN LET E$ I
 A)=
5607 IF E$(I,A)=  ' THEN GOTO 56
20
5610 NEXT A
5615 GOTO 5700
5620 LET E$(I,A)=
5625 RETURN
5700 LET R=1
5710 PRINT AT 17,20, THATS   AT
18,20,'CHEATING' AT 19,20, TRY IT
  AT 20,20, AGAIN ,AT 21,20, PRO
FERLE'
5720 PAUSE 50
5730 RETURN

5999 REM ****************

6000 FOR I=1 TO P
6001 FOR M=1 TO 7
6020 LET E$(I M)=
6025 NEXT M
6027 NEXT I
6030 RETURN

6499 REM ****************

7000 IF B$(K J)= ■  THEN LET D=1
3
7005 IF B$(K J)=  THEN LET D=2
7010 IF B$(K J)= ■  THEN LET D=1
3
7015 IF B$(K J)= 2  THEN LET D=2
7020 FOR O=1 TO 26
7025 IF A$(O)=M$ THEN GOTO 7040
7030 NEXT O
7035 GOTO 7060
7040 IF O=3 THEN LET Z=Z+3+F(O)
7045 IF D  3 AND O<>2 THEN LET Z
=Z+F(O)
7050 IF D=3 THEN LET Z=Z+2+F(
7060 LET O=0
7065 LET D=0
7070 RETURN
7100 LET Z=Z+(2+Z)
7107 LET O1=0
7110 RETURN
7200 LET Z=Z+Z
7205 LET O1=0
7210 RETURN

7999 REM ****************

8000 DIM B$(15,15)
8001 DIM A$(26)
8002 DIM F(26)
8005 DIM C$(100)
8007 LET X=0
8010 FOR I=38 TO 63
8011 LET X=X+1
8015 LET F(X)=1
8016 LET A$(X)=CHR$ (I)
8020 NEXT I
8024 LET F(7)=4
8025 LET F(9)=4
8030 LET F(22)=4
8035 LET F(22)=4
8040 LET F(13)=3
8045 LET F(3)=3
8050 LET F(15)=3
8055 LET F(2)=2
8060 LET F(4)=2
8065 LET F(7)=2
8070 LET F(6)=7
8075 LET F(11)=5
8080 LET F(10)=3
8090 LET F(24)=3
8095 LET F(17)=10
8097 LET F(25)=4
8100 LET F(22)=10
8105 FOR I=1 TO 9
8110 LET C$(I)= A
8115 NEXT I
8120 LET C$(10 = B
8125 LET C$(11)= B
8130 LET C$(12)= C
8135 LET C$(13)= C
8140 FOR I=14 TO 17
8145 LET C$(I)= C
8150 NEXT I
8155 FOR I=18 TO 29
8160 LET C$(I)= E
8165 NEXT I
8170 LET C$(30)= F
8175 LET C$(31)= F
8180 LET C$(32)= G
8185 LET C$(33)= G
8190 LET C$(34)= G
8195 LET C$(35)= H
8200 LET C$(36)= H
8205 FOR I=37 TO 45
8210 LET C$(I)= I
8215 NEXT I
8220 LET C$(46)= J
8225 LET C$(47)= K
8230 FOR I=48 TO 51
8235 LET C$(I)= L
8237 NEXT I
8240 LET C$(52)= M
8245 LET C$(53)= M
8250 FOR I=54 TO 59
8255 LET C$(I)= N

8260 NEXT I
8265 FOR I=60 TO 67
8270 LET C$(I)= O
8275 NEXT I
8280 LET C$(68)= P
8285 LET C$(69)= P
8290 LET C$(70)= Q
8295 FOR I=71 TO 76
8300 LET C$(I)= R
8305 NEXT I
8310 FOR I=77 TO 80
8315 LET C$(I)= S
8320 NEXT I
8325 FOR I=81 TO 86
8330 LET C$(I)= T
8335 NEXT I
8340 FOR I=87 TO 90
8345 LET C$(I)= U
8350 NEXT I
8355 LET C$(91)= W
8360 LET C$(92)= W
8365 LET C$(93)= W
8370 LET C$(94)= W
8375 LET C$(95)= X
8380 LET C$(96)= Y
8385 LET C$(97)= Z
8390 LET C$(98)= Z
8395 LET C$(99)= ■
8400 LET C$(100)= ■
8402 FOR T=1 TO 15
8405 FOR I=1 TO 15
8410 LET B$(T,I)= .
8415 NEXT I
8420 NEXT T
8425 FOR T=1 TO 15 STEP 7
8430 LET B$(1,T)= ■
8435 LET B$(15,T)= ■
```

```
8440 NEXT T
8445 LET B$(8,1) = ■
8450 LET B$(8,15) = ■
8455 FOR I=2 TO 5
8460 LET B$(I I) = ■
8465 LET B$(16-I I) = ■
8470 LET B$(16-I 16-I) = ■
8475 LET B$(I,16-I) = ■
8480 NEXT I
8485 FOR I=2 TO 14 STEP 4
8490 LET B$(6,I)='2
8495 LET B$(10 I) = 3
8500 NEXT I
8505 LET B$(7,3) = 2
8510 LET B$(7 7) = 2
8515 LET B$(7,9) = 2
8520 LET B$(7 12) = 2
8525 LET B$(2,4) = 2
8530 LET B$(3 8) = 4
8535 LET B$(3 12) = 2
8540 LET B$(9,3) = 2'
8545 LET B$(9,7) = 2
8550 LET B$(9,9) = 2
8555 LET B$(9 13) = 2
8560 FOR I=6 TO 10 STEP 4
8565 LET B$(2,I)='3
8570 LET B$(14 I) = 3
8575 LET B$(I,2) = 3
8580 LET B$(I,14) = 3
8585 NEXT I
8590 FOR I=7 TO 9 STEP 2
8595 LET B$(3,I) = 2
8600 LET B$(13 I) = 2
8605 LET B$(I,3) = 2
8610 LET B$(I,13) = 2
8615 NEXT I
8620 LET B$(4,8) = 4
8625 LET B$(12,8) = 2
8630 FOR I=4 TO 12 STEP 8
8635 LET B$(1,I) = 2
8640 LET B$(15,I) = 2
8645 LET B$(I 1) = 2
8650 LET B$(I,15) = 2
8655 NEXT I
8660 DIM Z$(26)
8663 LET O=0
8665 FOR I=33 TO 60
8667 LET O=O+1
8670 LET Z$(O)=CHR$ (I)
8675 NEXT I
8680 RETURN

8999 REM ----------*----------

9000 PRINT "TOO MANY PLAYERS?"
P TO FOUR"
9001 INPUT P
9002 IF P>4 OR P<1 THEN GOTO 900
1
9005 DIM E$(P,7)
9010 DIM X(P)
9012 DIM X$(P,10)
9013 GOSUB 6000
9015 FOR I=1 TO P
9020 PRINT
9021 PRINT "PLAYER" I "WHAT I

9022 PRINT "YOUR NAME? ,
9025 INPUT N$
9027 LET X$(I)=N$
9030 PRINT N$

9031 PRINT
9035 NEXT I
9040 PRINT "PLEASE WAIT WHILE I
SET UP THE BOARD
9050 PAUSE 150
9052 CLS
9055 FAST
9060 RETURN

9499 REM ++++++++++++++++++++++

9500 PRINT AT 0,13 '111111
9505 PRINT AT 1,4 1234567890111
45
9506 LET V=0

9507 PRINT AT 2,4 ■■■■■■■■■■■■■■■■
■■■■ AT 2,2 ■ AT 2 15 ■
9510 FOR C=1 TO 15
9511 LET V=V+1
9515 PRINT AT V+2 1 C AT V+2 I
■
9517 PRINT E$(C) ■
9520 NEXT C
9520 PRINT ■■■■■■■■■■■■■■■■
9525 PRINT AT 12 I ■ AT 12 14
■

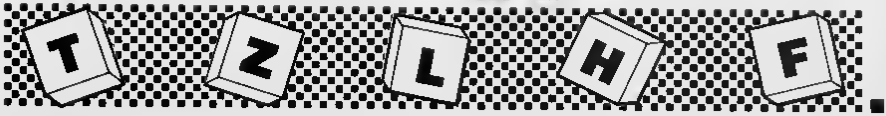
9540 RETURN

9899 REM ++++++++++++++++++++++

9900 CLS
9901 PRINT AT 10 0 "THERE ARE NO
MORE LETTERS LEFT"
9904 PRINT "YOU MUST PLAY ON WIT
IL NONE OF YOU P, CAN MAKE A
N, MORE WORDS"
9905 PAUSE 200
9906 CLS
9907 PRINT AT 10 0 "CAN ANY OF
OU GO"(Y/N)
9908 INPUT N$
9909 IF V$= N THEN GOTO 9950
9910 CLS
9911 GOSUB 9900
9912 FOR I=1 TO P
9917 FOR C=1 TO 11
9918 PRINT AT C 20 "
9920 NEXT C
9922 PRINT AT 1,20 X$(I) AT 20
"YOUR LETTERS" AT 5 20 "ARE" A
T 7,20
9925 FOR A=1 TO 7
9926 PRINT E$ I,A)
9927 NEXT A
9930 PRINT AT 9 20 "CAN YOU" AT
11,20, "GO ON ?"
9932 INPUT S$
9935 IF S$= N THEN GOTO 9910
9937 LET V=1
9938 IF S$= THEN GOSUB 99
9940 NEXT I

9970 GOTO 9906

9980 CLS
9981 GOTO 6000
9997 STOP
9998 SAVE "SCRABBLE"
9999 RUN
```



ZX81 Soft Selection

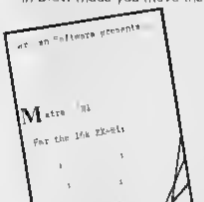
Nick Pearce is back with some more new '81 Software.

Matre 81 Arctan Software

Matre 81 is an interesting graphics program with some unusual functions for the 16K ZX81. Probably the most unique is kaleidoscope, where anything drawn in the top right hand quadrant of the screen is mirrored in the other three quadrants.

There are some thirty functions in all. To start you are presented with a blank screen and asked how many pictures you wish to draw — up to eight separate pictures can be handled by the computer.

In Draw mode you move the



cursor around the screen to produce the required pattern or picture. You can move horizontally, vertically, and diagonally (eight directions in all). The drawing area has 43 vertical and 64 horizontal pixels, so picture resolution is not all that good.

Function mode can be called up at any time. Each function is called by a single character, and you are asked to confirm that any selected function is indeed required before it is operated. This slows things up a little, but does reduce the probability of error. The functions available include the usual Copy, Save and Load routines as well as such features as Invert, Fill (to fill the screen with a specified character), Charborder (to get a border using your own choice of character), Store and Recall (to get pictures into and out of memory) and Cursoring (which moves the cursor directly to a specified corner of the screen).

There is an animate function which displays each picture consecutively. However as there is a maximum of eight pictures, animation is strictly limited.

All the features worked as indicated on the comprehensive sheet that is included with the cassette. The program is entertaining and is very easy to use. I am afraid that I am unable to illustrate this review with any of my doodles as my Sinclair printer has thrown a wobbly — well I did drop it. Is there anyone out there who can repair the little beasties?

Matre 81 costs £3.75 (cheque payable to MG Huggins) from Arctan Software, Suite 2, Assurance House, 35-41 Hazlewood Road, Northampton NN1 1LG.

Pooter Puzzler and Muse of Pooter Pooter Games

Pooter Puzzler contains a collection of four word games, all for the 16K ZX81.

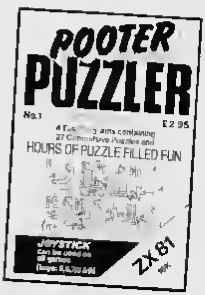
The first is called Sortition. The computer holds 26 nine letter words, each starting with a different letter of the alphabet. The player selects a letter from A to Z, and the computer displays an anagram of the stored word beginning with that letter. Your task is to solve the anagram, and sort the letters in to their correct order. Sorting is not easy since it has to be done by progressively reversing the order of the displayed letters — from the left only. A score is kept (number of moves taken) which the computer averages out as more words are attempted. There is also a two player option.

Sortition is quite a good game, but can be rather frustrating at times particularly as there is no way of giving in and requesting the answer — although you can escape by pressing the break key.

The next game on the cassette is Switch Quiz, which I thought was jolly good fun. It is a quiz where the answer to each question is either true or false. You get points for giving the correct response, and the faster you answer the more points you get. For an incorrect answer points are lost. To start you make a selection from the nine topics available, from pop history and film buff, to sport and British birds. It is then up to you to give the correct response to each question as quickly as possible, and reach the maximum permitted score of 90 points in the shortest possible time. The questions have been carefully thought out and it is easy to give a wrong answer under the pressure of time. Good use has been made of ZX81 graphics with a points scoring clock displayed throughout the game.

Next comes Wordslide, containing eight puzzles. Each puzzle is a four by four grid containing four words with their letters jumbled up. You have to move the letters around the grid to recreate the four words. It is a ZX81 version of the popular novelty puzzle. An enjoyable game with graphics again used to good effect.

Finally on this cassette is Word Scanner. Thirty or more words are hidden in a 16 by 16 grid. They may be horizontal, vertical, or along a diagonal. The object of course is to find each word. Ten puzzles are available, each based on a theme such as top thirty, British mountains and garden roses. The game is easy to use by simply moving a



cursor around the grid and firing to lock on to the located word. A list of the hidden words is displayed.

All four games on this cassette worked well. They have obviously been carefully thought out and were enjoyable to play. They can all be played using a joystick.

Also from Pooter Games is an interesting novelty for the expanded ZX81 called *Muse of Pooter*, a program which creates prose. Short sentences are generated and displayed, with words and syntax chosen at random.

Most of the phrases it generated whilst I used the program seemed plausible, even profound at first sight, but on closer inspection probably 90% in fact made no sense. Occasionally though, a real beauty appears — so switch on and let the Muse of Pooter set you pondering.

Pooter Puzzles and Muse of Pooter are available by mail order from Pooter Games, 24 Parsloes Avenue, Dagenham, RM9 5NX.

Bouncing Bert Software Farm

The last Software Farm game for the ZX81 reviewed in these pages featured high resolution graphics. Normal ZX81 graphics for *Bouncing Bert* but the display and animation are very good nevertheless. The program requires 16K of RAM.

Bouncing Bert is not the usual pinman, but a substantial character who can move forwards, backwards, and can jump. The object of the game is to guide him from platform to platform to collect some keys and return them to the start. There are three keys to collect in all, and there are plenty of hazards to trap the intrepid Bert, including weeds and deathly skulls.

An interesting aspect to this game is that everything from Bert to the skulls and weeds is on a large scale. This means that only a small part of the game can be seen on screen at any time. This makes it difficult to plan a route to the keys and only after a number of attempts after which the course is learnt is success likely.

Bouncing Bert is an enjoyable game, and good use is made of the ZX81 graphics for the display and animation. Available from Software Farm, 3rd Floor, 16 Charlotte St, Bristol BS1 5PP.

BUZZ!

Derek Mearns has been a busy little B — he can be seen buzzing around the Witney Honey pots.

In this game for the 16K ZX Spectrum you must manoeuvre the fly around the orchard to the fence on the other side. It differs from the normal arcade games in that your movements are via an input statement at the beginning rather than by INKEY$ during play.

When run you will see a short title display followed by the difficulty input. This determines how many apples you will get (eighteen times the difficulty level). The screen display will then appear, with you at the bottom and the fence at the top. You will then see the prompt 'O K!' indicating that you should now enter your commands using the cursor keys. All the commands should be entered at the beginning. For example, if there was a straight path to the other side except for one apple blocking your way, then your input may be

'7777777577877777777

Notice that it is not necessary to finish at the fence, you may overshoot it. However, you may not undershoot it. Should the maze be impossible entering 0 will return you to the start.

Program Description

Here follows a brief breakdown of the program and a list of the variables used. (See figure 1)

Figure 1 Program Description)

10-38	Set up User Defined Graphics and input difficulty
39-50	Draw screen display
60-70	Input commands
80-260	Move fly and check to see if at fence or crashed
280-290	The fly crashes
320-360	The fly reaches the fence
400	End of command and fly not at fence
1000-1020	Another go?
9000-9520	Print title and instructions
dif	Difficulty level
x,y	Co-ordinates of the fly
g$	Your command
n	Next command to be read in g$ FOR NEXT loops
a$	Temporary scrolling messages
f,g	FOR NEXT loops


```
  1 REM ***********************
        *Underlined characters*
        *are entered in       *
        *GRAPHICS mode.       *
        ***********************
  5 GO SUB 9000
  10 RESTORE
  20 FOR g=144 TO 147: FOR f=0 T
O 7: READ a: POKE USR CHR$ g+f,a
: NEXT f: NEXT g
  30 DATA 0,6,8,28,62,62,62,28:
DATA 36,24,60,90,153,153,165,195
  33 DATA 240,136,69,62,62,69,13
6,240: DATA 8,255,8,255,8,8,8,8
  35 INK 7: PRINT AT 8,3;"Enter
Difficulty (1 TO 10)": INPUT dif
: IF dif<1 OR dif>10 THEN  GO TO
 35
  37 LET dif=INT dif: LET dif=di
f*18: PRINT AT 8,3;"
                    ";AT 1,1;"
                              "
  38 PRINT AT 9,1;"
                    "
  39 INK 6: PRINT AT 0,1;"DDDDDD
DDDDDDDDDDDDDDDDDDDDDDDD"
  40 PAPER 0: INK 4: FOR f=1 TO
dif: PRINT AT INT (RND*15)+1,INT
 (RND*30)+1;"B": NEXT f
  50 LET x=16: LET y=15: INK 7:
PRINT AT 16,14;" B "
  60 INPUT "O.K! ";LINE g$: IF
LEN g$<1 THEN  GO TO 60
  65 IF g$="0" THEN  GO TO 1
  70 FOR n=1 TO LEN g$: IF g$(n)
<>"5" AND g$(n)<>"6" AND g$(n)<>
"7" AND g$(n)<>"8" THEN  GO TO 6
0
  80 NEXT n: FOR n=1 TO LEN g$:
PRINT AT x,y;"B": PAUSE 20: IF g
$(n)="5" THEN  GO TO 120
  90 IF g$(n)="6" THEN  GO TO 16
0
  100 IF g$(n)="7" THEN  GO TO 20
0
  110 IF g$(n)="8" THEN  GO TO 24
0
  120 INK 7: IF ATTR (x,y-1)=2 TH
EN  GO SUB 280: PRINT AT 19,0; F
LASH 1;" YOU FLEW INTO A WALL AN
D DIED! ": GO TO 300
  130 IF ATTR (x,y-1)=4 THEN  GO
SUB 280: PRINT AT 19,0; FLASH 1;
"YOU ATE A DEADLY APPLE AND DIED
!": PAUSE 200: GO TO 300
  140 PRINT AT x,y;" ": LET y=y-1
```

```
: BEEP .2,10: NEXT n: GO TO 400
 160 IF x>14 THEN  GO SUB 280: P
RINT AT 19,0; FLASH 1;" YOU FLEW
 INTO A WALL AND DIED' ": PAUSE
200: GO TO 300
 170 IF ATTR (x+1,y)=4 THEN  GO
SUB 280: PRINT AT 19,0; FLASH 1;
"YOU ATE A DEADLY APPLE AND DIED
'": PAUSE 200: GO TO 300
 180 PRINT AT x,y;" ": LET x=x+1
: BEEP .2,10: NEXT n: GO TO 400
 200 IF x<2 THEN  GO TO 320
 210 IF ATTR (x-1,y)=4 THEN  GO
SUB 280: PRINT AT 19,0; FLASH 1;
"YOU ATE A DEADLY APPLE AND DIED
'": PAUSE 200: GO TO 300
 220 PRINT AT x,y;" ": LET x=x-1
: BEEP .2,10: NEXT n: GO TO 400
 240 IF ATTR (x,y+1)=2 THEN  GO
SUB 280: PRINT AT 19,0; FLASH 1;
" YOU FLEW INTO A WALL AND DIED'
 ": PAUSE 200: GO TO 300
 250 IF ATTR (x,y+1)=4 THEN  GO
SUB 280: PRINT AT 19,0; FLASH 1;
"YOU ATE A DEADLY APPLE AND DIED
'": PAUSE 200: GO TO 300
 260 PRINT AT x,y;" ": LET y=y+1
: BEEP .2,10: NEXT n: GO TO 400
 280 PRINT AT 6,0;"
```

```
 285 INK 2: FOR f=6 TO 10: PRINT
 AT f,0;"█";AT f,31;"█": NEXT f
 290 INK 0: PAPER 3: RETURN
 300 GO TO 1000
 320 PRINT AT 6,0;"
```

```
 330 INK 2: FOR f=6 TO 11: PRINT
 AT f,0;"█";AT f,31;"█": NEXT f
 340 FOR g=1 TO 2: FOR f=20 TO 4
0 STEP 3: BEEP .1,f: NEXT f: NEX
T g
 345 LET a$="''''''WELL DONE,YOU
MADE IT''''''"
 350 PRINT AT 19,1; INK 2;"BBBBB
BBBBBBBBBBBBBBBBBBBBBBBBB": FOR
 f=1 TO 30: PRINT AT 19,f; INK 7
;a$(f);"C": PAUSE 15: NEXT f
 360 GO TO 1000
 400 GO SUB 280: PRINT AT 19,0;
FLASH 1;"      YOU DID'NT MAKE IT
 '       "
1000 FOR f=1 TO 500: NEXT f
1010 INK 6: PAPER 0: PRINT AT 19
,0;"Press any key to play again
    ": IF INKEY$="" THEN  GO TO
1010
1020 RUN
9000 PAPER 0: BORDER 0: CLS
9003 BORDER 0: PAPER 0: CLS : IN
K 2: FOR f=0 TO 3: PLOT f,40: DR
AW 0,135: PLOT 0,175-f: DRAW 255
,0: PLOT 255-f,175: DRAW 0,-135:
 PLOT 255,40+f: DRAW  255,0: NEX
T f
9004 FOR f=1 TO 4
9005 INK 6
9010 LET a$="BUZZZ *************
***********": FOR n=31 TO 1 STEP
 -1: PRINT AT 1,n;a$( TO 31-n):
NEXT n
9015 FOR n=1 TO 7: PRINT AT 1,1;
a$(n TO ): NEXT n
9017 LET a$="  DEREK MEA
RNS  ":
9020 INK 5: FOR n=30 TO 1 STEP -
1: PRINT AT 1,n;a$(n): NEXT n
9025 NEXT f
9100 RETURN
9200 CLS : INK 7: PRINT AT 0,0;"
   The object of this game is to
guide Fred the Fly(B) around the
orchard.Unfortunately Farmer
Brown doesn't like flies and he
has poisoned all the apples in
his orchard.Fred will die unless
";
9210 PRINT AT 6,0;"you can guide
 him into the next orchard where
 the apples are notpoisoned.The
only way into this orchard is th
rough the fence at the top(Q)"
9220 PRINT AT 11,0;"   To guide
Fred use the cursor keys BUT you
 must enter your     route accros
s the orhard all at once.The com
puter will ask you  for this wit
h the prompt 'O.K'   "
9230 PRINT "   Pressing any key
while Fred  is moving will make
him fly     faster.Should it be
impossible  to fly through enter
ing '0' willstart the game again
."
9240 PRINT AT 21,0; INK 6;"Press
 any key to start": IF INKEY$=""
 THEN  GO TO 9240
9250 RETURN
```

IF YOU USE YOUR COMPUTER TO PLAY GAMES, THEN YOU CAN'T AFFORD TO MISS.

Computer GAMER

This fantastic new magazine appears on the fourth Friday of every month price of 95p.

Each issue will be produced in cooperation with Eccen our Interplanetary Adviser who on his home planet, Aargon, is a member of the Association of Supreme Players. He will be monitoring developments in the games industry and advising Computer Gamer readers with all their gaming problems. Included in each issue will be pages of review of the latest games releases, special Adventure features and a help-line, invaluable articles on how to 'crack' specific games a high-score page, exciting programs to type in for most of the popular home computers, news, competitions, reviews of peripherals and computers themselves if relevant to the games field and LOTS more.

Also, all readers of Computer Gamer will have the opportunity to join our tremendous Reader's Club — each member will receive a membership card and a regular newsletter which will contain up-to-the-minute news and all sorts of offers on a variety of products.

So all-in-all there's no way you can afford to be left out of the great new revolution in games computing — rush out and buy your copy NOW!

Problem Page

Chess

Dear Sir
Some time ago I bought a 1K Chess program for my ZX81. After trying several times it seemed impossible to BREAK the program. Do you know how this is done because I have a program in my head which I don't want to be broken.

Th P. Van Nunspeet
The Netherlands

Well, presuming it is the program and not your head which you want to prevent from being broken, then this can be a simple problem providing your program is in machine code. I too have this chess program and it is a masterpiece of programming, the code is held in a REM line at the beginning of the program and the BASIC simply consists of two lines

10 SAVE "CHESS"
20 RAND USR number

So if your program is in machine code held in a first line REM just add two similar lines to the end of your program remembering to put 'number' equal to the machine code call address (often 16514) of the start of your program.

Now save your program by typing GO TO 10 and pressing NEWLINE. Every time the program is reloaded from the tape it will auto start and provided your machine code does not allow BREAK to halt the program it will be protected.

Saving a program in this way will also autostart a BASIC program if the RAND USR number is replaced by GOTO line number but preventing a BASIC BREAK is too complex to tackle here.

Eraser

Dear Sir
I have been looking for a way to erase a BASIC program if the program is stopped while loading so revealing the structure of the program and also making it easier to be copied.

I have found the POKE commands to erase the program if the BREAK/SPACE key is pressed when the program has loaded. I wish to find a POKE command to erase the program if the program is stopped while loading. Can you help me? I own a 48K Spectrum and thoroughly enjoy your magazine.

Michael Conety
Dublin

This seems to be of interest at the moment. There really is no foolproof way of protecting a program, just look at the time and effort commercial companies take, and still the hackers get in! Without recourse to machine code and one of two other tricks, the simplest way is to have one or two pre loaders each depending on a secret code you implant for the next to work. The main program could be saved as bytes loaded to a different memory location and therefore only be reloaded by the correct pre loader.

Say for instance you have a BASIC program. SAVE it as bytes by having a program line such as

9990 SAVE "prog" CODE 23552, (PEEK23641 + 256 * PEEK23642) – 23552: 9995 GO TO 10

*Now if it is reloaded using LOAD "" CODE, then it will load to the original address and continue from where it left off, this we don't want — yet. First find the length of the program saved with PRINT (PEEK 23641 + 256 *PEEK 23642) – 23552 and make a note of it. Make a pre loader by entering a program such as*

10 POKE 23659,0: POKE 65365,0: REM cause crash on break
20 LOAD "" CODE 23552

By clever use of colour, line 20 can be in white ink on white paper ie invisible! Or by a similar technique made to look as if it reads LOAD "" or even LOAD "" CODE. It all adds to the hackers confusion.

Save it by SAVE "p1" LINE 10. Now reload the first program to a different address by CLEAR 32999 (or some such address) and LOAD "" 33000. Re save by SAVE "prog" CODE 33000, length of prog as noted after your pre loader program. Now a simple LOAD "" CODE will be of no use!

Saving from different areas of the System variables helps to prevent others getting used to the technique. There are lots of possible tricks which can be used, but none are foolproof, all you can really do is make life difficult and hope the would be hacker gives up.

Convertable?

Dear Sir
Having used a ZX81 for years I have acquired a Spectrum. Although I intend to keep the ZX81 and keyboard as a backup, life would be much easier if I could load my BASIC ZX81 tapes into the Spectrum — to avoid the need to type them all out again.

Do you Know of any conversion tape still available? I have tried ELR, Amersham and Ness.

Mr M. Anthony
Cheshire

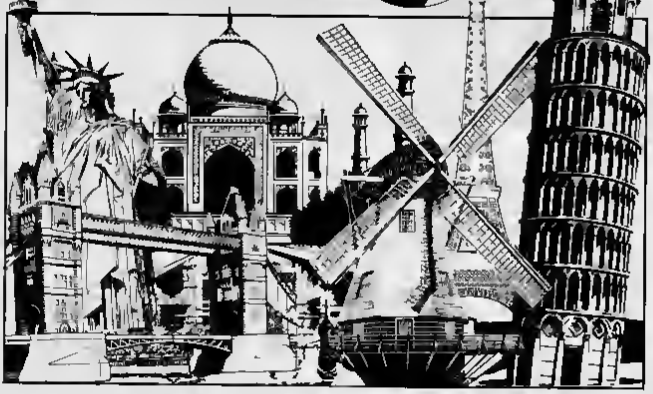
The answer is simple: no! The ELR one is the only one we knew of, but this one only worked with issue 1 Spectrums. Perhaps if there is such a product in existence someone will let us know about it. Meanwhile it might be an interesting project for an enterprising expert out there.

David has dealt with the bulk of the problems personally this issue and we were left with only these few. However, I will be looking after this page for a while to allow David to work on his new project so send in your program, hardware or general problems and queries to me.

Sperky
Problem Page
ZX Computing
No 1 Golden Square
London W1R 3AB

And I look forward to a challenging and interesting time.

Club corner



ZX81 club

Dear Editor
In March of this year one of your rival magazines printed an appeal by myself for ZX81 owners and users to contact me if they were interested in establishing a ZX81 postal users club. Over two dozen people replied (including one each from Canada, Germany, New Zealand and Sweden). This excellent response has resulted in tentative steps being taken to form such a club.

Facilities and services which we hope to be able to provide include: address exchange, discount software (over 50 titles at less than £3.00 each!), International and Junior sections, newsletter etc.

Therefore I would like to ask, through your columns, that ALL ZX81 owners and users who would be interested in joining a club EXCLUSIVELY for themselves, please write to me at the above address for further information and a questionnaire. Would all respondents please be kind enough to enclose a stamped addressed envelope or an International reply coupon. Many thanks!

Yours sincerely
Ian Dale
78 Cobden St
Thornaby, Stockton on Tees
Cleveland TS17 7ET

Strathclyde club

Dear ZX Computing,
I am starting a new nationwide Sinclair User Club. Each week I will send members a newsletter which will consist of games reviews, tips, short routines, discount computer games and more.

The cost of membership will be:
Spectrum — £1.0 per year or £1 per month
ZX81 — £5 per ysar or £0.50 per month

Your money will contribute towards postage, discount games tapes and to any other surprises that may appear in the newsletter. I think you will find the lub good value for money, but if you don't enjoy it you will have a money back guarantee for the first two months.

If you are interested please contacf

Ian Kennedy
24 Waverley Crescent
Lanark, Scotland

Spain

Hello friends of ZX Computing.
I am the president of the programmers club of Castellon (Spain), and I would like to know people from all over the world who own Sinclair, Commodore or Astra computers.

We (the members of the club) want to exchange ideas, programs etc without any financial interest involved.

Our address is

Jose Manual Martin Sautos
Spdo 635, Castellon
Spain.

Penpal

Dear ZX Computing
I am fourteen years old and would like a penpal who has a Spectrum 48K. I have an Interface 2 and joystick for my Spectrum 48K.

Yours faithfully
G. Bentham
PO Box 73
Ngodwana, N.E. Transvaal
RSA 1209

While we're on the subject of S. Africa, we've had a letter from a Peter Hupton, and also from the 'ZX Mushroom Club', both of whom are looking for penpals/new members but didn't send in their full addresses. So if they're reading this and would like to write again with their addresses, we'd be happy to publish their letters.

France

Dear ZX Computing
I would be very pleased if you would publish this letter.

I am French and live near Paris, and I own a 48K Spectrum. I would like to become a member of a Spectrum club as I would like to exchange ideas, news and programs with British users.

If there are any clubs that correspond with French or European users, please write to me at the address below.

Yours faithfully
Pajard Jerome
57 Rue Segoffin
92400 Camberoie
France

Eire

Dear ZXC
I would like to tell any of your North Kildare readers that I hope to form a small club of Spectrum owners. Anybody in the area who is interested may write to me, enclosing s.a.e., or phone after 7pm at (045) 68144.

Yours sincerely
Owen O'Connor
Downings North
Prosperous
Co. Kildare, Eire

De-bugger

Getting a program typed in is often only the start of your problems. Ed to the rescue.

Typing in a program is a useful exercise. Apart from the patience required, techniques learned and the end program to be used, probably the most educational part of it is tracking down the bugs introduced by yourself or occasionally by our publication system.

In debugging you gain a much deeper insight and understanding on how the program actually works than by merely typing it in, but tracking down these errors is an art in itself and needs some skill. So here are some tips to help you in your efforts when faced with that cryptic error report!

1 NEXT without FOR
Look back through the program, either the loop has not been set up — no related FOR letter = No1 TO No2 line, or the letter has been re-used as an ordinary variable within the loop with a LET letter = No.

2 Variable not found
This is one of the most common errors. Again, the problem may not lie in the line where the error was detected and reported. If there is only one variable which may be one or more letters or a string ($) variable, then that is the problem. There may be more than one variable in the line section reported and you will have to identify the offending one. In a line PRINT AT Y,X A$ the culprit could be Y or X or A$. To find out which of them is causing the problem (it may be more than one) type in turn as a direct command:

PRINT Y Enter/Newline
PRINT X Enter/Newline
PRINT A$ Enter/Newline

Note which produces the error report. Now look back through the program printout for the line which sets it up — usually a LET or FOR command. Did you leave it out? Does the program get there or has a GOTO/GOSUB been wrongly addressed?

3 Subscript wrong
Connected with DIM A(No) or DIM A$(No). If the number in the brackets on the line where the error is reported is greater than the one in the original DIM statement, is not an integer or is less than 1, then this report is generated. If the subscript — number in brackets — is a number then check and change, however, if it is a variable then follow the procedure for tracing variables. It has probably exceeded the limits: look for lines with the variable being altered with + − * /. If necessary add limiting code. For example:

IF X >10 THEN LET X = 10

4 Out of memory
As well as for programs which are too big, it may happen if the previous program set RAMtop. Before despairing, enter CLEAR USR a 1 on the Spectrum on the ZX81 SAVE the program, turn the machine off and on then reload the program.

7 RETURN without GOSUB
Somehow the computer has reached a RETURN command other than via a GOSUB instruction. Check a GOTO hasn't been entered in place of a GOSUB. Check for a missing GOSUB.

8 Integer out of range
An integer (whole number) either as a number of variable is too big or small and you are attempting to do something like PRINT AT 0,33 — not allowed! Check any variables involved as per report 2 and trace it back through the program looking for adjustments to it by + − * /. Add limiting code if needed — see report 3.

E Out of DATA
A Spectrum problem. Check the number of DATA items match the number of READs: usually one (or more) has been missed out. Attempting to reread a DATA list without first using a RESTORE command will cause this and it can happen on an auto start program (saved with a LINE number). Good programming usually RESTOREs to the correct line number before using READ.

I FOR without NEXT
See report 1 but this time the NEXT is missing!

Note that the letters I have used for examples could by ANY letters not just A$,X,Y etc and depend on the particular choice of the programmer.

This is by no means a comprehensive list but I have tried to cover many of the most common error reports. Personally, I get almost as much satisfaction from debugging as I do from programming. I do assure you however, that there is absolutely no truth in the rumour that we deliberately inject bugs into our listings in order to introduce you to the dubious delights of debugging!

Conversion tips

A guide to ZX81/Spectrum program conversions from David Nowotnik.

The versions of BASIC offered by the two ZX computers are so similar that many programs for one can be used by the other. The ZX81 has only two commands which are not present on the Spectrum: SCROLL and UNPLOT, and these should cause you few problems when converting ZX81 programs to the Spectrum (see Table 1).

There are quite a lot of commands and functions on the Spectrum which are not available on the ZX81. A list of these appears in Table 4. The sters indicate those commands and functions for which there is no simple translation to ZX81 BASIC. Those for colour and sound can be ommitted, but you will have to find some alternative for the high resolution and file I/O commands.

The command PLOT appears on both computers but the effect is quite different, so beware! Another tip: PEEK and POKE should be used with caution. In conversion addresses will almost certainly have to be changed. Some of those changes appear in the tables. A command such as POKE USR ' ' on the Spectrum indicates User Defined Graphics. ZX81 users don't have this facility, so you'll have to omit this and use a standard character instead.

ZX81	Spectrum	Comments
SCROLL	RANDOMISE USR 3582 or LET t=USR 3582	If the program uses random numbers they could become rather predictable with the first option. If so, use the second, using a variable (in this case t) which is otherwise not used
PLOT Y X	PRINT AT 21 – Y/2 X/2	Print the appropriate quarter square graphics character
UNPLOT Y,X	PRINT AT 21 – Y/2 X/2	Print a space, or the appropriate quarter square graphics character

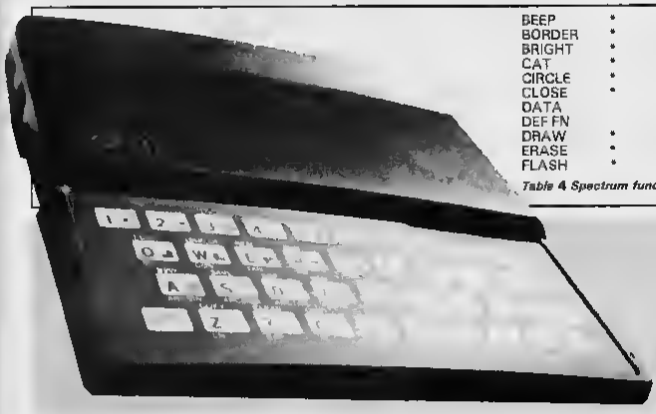
Table 1 ZX81 to Spectrum conversions

Spectrum	ZX81	Comments
BIN eg LET y=BIN 10010101	LET y=(decimal no.) Conversion to decimal 10010101=149 128 64 32 16 8 4 2 1 Add these numbers together when a 1 appears at the appropriate position in binary	BIN allows the representation of a number in binary. On the ZX81 use the decimal equivalent, but beware, BIN is often used with User Defined Graphics which are not available on the ZX81
READ/DATA eg READ x,y DATA 50,60	LET LET X=50 LET Y=60	READ and DATA are used to store a lot of information in a program. Use LET instead
DEF FN and FN eg DEF a(x)=SQR x LET t=FN a(i)	LET X$=" SQR X" LET X=I LET T= VAL X$	The defined function can appear in a string. Use the keyword for built in functions (eg SQR). The equivalent of FN may need 2 lines, as shown
PLOT	no equivalent	
SCREEN$ eg LET a=SCREEN$ x,y	LET A=PEEK(PEEK 16396 +256*PEEK 16397+1+Y+33*X)	Used in interactive games to detect characters in the display file. Note — this formula only works when a RAM pack is fitted

Table 2 Spectrum to ZX81 conversions

ZX81	Spectrum	Comments
1 FRAMES POKE 16436,255 POKE 16437,255 LET T=(65535-PEEK 16436-256*PEEK 16437)/50	POKE 23672,0 POKE 23673,0 LET t=(PEEK 23672+256*PEEK 23673)/50 For times greater than 10 minutes you can use byte 23674 as well.	Both computers have a counter which accurately varies by 50 every second. In the example use the first line to start the 'clock'. The variable T will have the time in seconds after the start. The counter can only be used for 10 minutes
2 Line number zero POKE 16510,0	POKE 23756,0 (As the start of BASIC can move, eg with microdrives) use with caution	Converts the first line of a program to line number zero which cannot be edited, and so is protected
3 RAMTOP POKE 16388,X-256*INT (X/256) POKE 16389, INT (X/256)	CLEAR x	Creates a safe area at the top of RAM starting at address x, for storing data, machine code etc

Table 3 General interconversion hints



BEEP	*	FORMAT	*	ATTR	*
BORDER	*	INK	*	BIN	
BRIGHT	*	INVERSE		FN	
CAT	*	MERGE	*	IN	*
CIRCLE	*	MOVE	*	OVER	*
CLOSE	*	OPEN	*	POINT	*
DATA		OUT	*	SCREEN$	
DEF FN		PAPER	*	VAL$	*
DRAW	*	READ			
ERASE	*	RESTORE	*		
FLASH	*	VERIFY	*		

Table 4 Spectrum functions not available on the ZX81

System Variables Conversion Table.

Variable	ZX81/ T/S1000	Spectrum/ TS2068
BREG	16414	23655
CDFLAG	16443	No Equivalent
CH ADD	16406	23645
COORDS	16436	23677
COORDS (Byte 2)	16439	23678
DEST	16402	23629
DF CC	16396	23684
D FILE	16396	No Equivalent
DF SZ	16416	23659
E LINE	16404	23641
ERR NR	16384	23610
E PPC	16294	23625
ERR SP	16386	23613
FLAGS	16385	23611
FLAGX	16429	23665
FRAMES	16436	23672
LAST K	16421	23560
MARGIN	16424	No Equivalent
MEM	16415	23656
MEMBOTT	16477	23698
MODE	16390	23617
NXTLIN	16425	23637
OLDPCC	16427	23662
PPC	16391	23621
PRBUFF	16444	23296
PR CC	16440	23680
RAMTOP	16388	23730
SEED	16434	23670
S PSN	16441	23688
S POSN (Byte 2)	16442	23689
STKBOT	16410	23651
STKEND	16412	23653
S TOP	16419	23660
STRLEN	16430	23666
T-ADDR	16432	23668
VARS	16400	23627
VERSN	16393	No Equivalent
X PTR	16406	23647

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